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Drive-By Geography: Perceptions of Urban Growth and Land Use in Hattiesburg, Mississippi

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DRIVE-BY GEOGRAPHY: PERCEPTIONS OF URBAN GROWTH AND LAND USE IN HATTIESBURG, MISSISSIPPI

by

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ABSTRACT

DRIVE-BY GEOGRAPHY: PERCEPTIONS OF URBAN GROWTH AND LAND USE IN HATTIESBURG, MISSISSIPPI

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One of the most important mechanisms in which human societies have transformed the earth is through urbanization. Land use changes such as from cropland to businesses are important ways in which urban growth transforms landscapes. This study uses qualitative and quantitative methods in order to visualize where urban growth and landscape changes are occurring between Hattiesburg and Columbia, Mississippi within the first decade of the 21st century. The methods I used involved conducting transects and creating hand-drawn maps, conversion of hand-drawn maps into ArcGIS shapefiles for interpretation and analysis, and lastly juxtaposition of shapefiles onto Landsat imagery. To analyze the data I wrote narratives, created a multiple ring buffer, and calculated the point density of the landscape features. The results of this research show that urban growth and related land use change is expanding in a pattern relative to that of the Burgess Model.

ACKNOWLEDGMENTS

I would like to thank my thesis advisor, Dr. David Cochran, and the other committee members, Dr. Jerry "Joby" Bass and Dr. Clifton "Skeeter" Dixon, for their advice and support throughout the duration of this project. I would especially like to thank Dr. David Cochran for his patience and diligence in helping me complete this project.

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CHAPTER I

INTRODUCTION

Urbanization is one of the most important mechanisms by which human societies transform the earth (Mumford, 1961). As the United States changed from an agrarian to an industrial society in the 19th century and to a post-industrial society in late 20th and early 21st centuries (Buttimer & Seamon, 1980; Hartshorn, 1980), its cities grew at unprecedented rates (Jordan-Bychkov, 2003; Mayhew, 2009; Short, 1984). Urbanization is generally defined as the spatial growth of cities in which economic and demographic resources, as well as land, are drawn from surrounding rural areas to feed urban expansion (Gregory, Johnston, Pratt, Watts, & Whatmore, 2009; Mayhew, 2009). In the United States, urbanization has been the result of a variety of societal changes brought on by industrialization, the invention of automobiles, electricity, sewer systems, immigration, the growth of railroads, highways, and other transportation infrastructure, and long-term, affordable mortgages (Gregory et al., 2009; Mayhew, 2009).

Prior to industrialization, American cities were essentially points on a map that occupied only a small fraction of the total land area of the United States. During the 20th century, however, they grew so much that they became regions in and of themselves (Berlin, 2002; Lewis, 1995; Miller, 1973; Mumford, 1961; Radeloff, Hammer, & Stewart, 2005; Teaford, 2008). Suburban sprawl, also referred to as urban sprawl, refers to the decentralization of urban and suburban areas and their expansion into rural areas of lower population density (Berlin, 2002; Radeloff et al., 2005). Rural sprawl refers to areas of scattered, low density, residential development beyond the suburbs, as well as the development of commercial strips along arterial highways leading into metropolitan

regions (Radeloff et al., 2005). Continual migration away from urban and suburban centers has led to the development of complex exurban landscapes that are mosaics of residential subdivisions, small towns, farmland, forests and woodlands, and unused space in areas once dominated by purely rural landscapes (Clark, McChesney, Munro, & Irwin, 2005; Hansen, Rasker, Maxwell, Rotella, Johnson, Parmenter, Langer, Cohen, Lawrence, & Kraska, 2002; Nelson, 1992; Spectorsky, 1955). As Jacobs (1984) stated, "…in the hinterlands of some cities – beginning just beyond their suburbs – rural, industrial and commercial work places are all mixed up together. . . " (Jacobs, 1984, p. 45).

Geographers and other social scientists have used a variety of quantitative and qualitative approaches to study urbanization (Aitken, Mitchell, & Staeheli, 2003). Standard quantitative analysis often focuses on the use of aerial and satellite imagery, as well as spatial-statistical examination of census data and other information. Qualitative approaches, on the other hand, which encompass a wide variety of ethnographic and humanistic techniques, seek to ascertain the meanings and roles of space and place in urbanization, by examining public places and landmarks, mapping urban, social, and cultural space, and assessing political-economic power and segregation within cities (Aitken et al., 2003; Marston, Towers, Cadwallader, & Kirby, 1989).

Since the 1970's, humanistic geographers have focused on understanding human interactions and relationships with the landscape in order to understand and explain the complexities and nuances of cities (Gregory et al., 2009; Jackson, 1994; Ley & Samuels, 1978; Mayhew, 2009). Humanistic geographers argue that the meaning of place is related to how people experience and value the landscape (Conzen, 1990; Groth & Bressi, 1997; Jakle, 1987; Relph, 1981; Tuan, 1977). In his seminal work, *Place and*

Placelessness, Edward Relph (1976) suggests that placeless landscapes lack meaning and are often products of rampant urbanization. He also argues that the lack of individual expression inherent in suburban and mainstream urban landscapes represents a form of placelessness that is coming to define increasingly large areas of the United States and other industrialized nations (Relph, 1976; Sara, 2008).

James Kunstler refers to suburbia and sprawl as the process of destruction which destroys the distinction between city and country life. He argues that the modern American landscape is really a landscape of scary places. "To me, it is a landscape of scary places, the geography of nowhere, that has simply ceased to be a credible human habitat" (Kunstler, 1993, p. 15). Kunstler's reference of a landscape of scary places means an ever changing landscape or one that is no longer unique.

There are also views that contrast the idea of placelessness. Richard Florida is known for his concept of the creative class. "Great thinkers, artists, and entrepreneurs-what I call the creative class-rarely come out of nowhere. They cluster and thrive in places where the conversation and culture are the most stimulating" (Florida, 2011, p. 75). He believes that the transition of economic growth depends on an area's ability to attract and keep the creative class. Blake Gumprecht focuses on college towns functioning as a unique type of urban place. According to Grumprecht a college is…"any city where a college or university and the cultures it creates exert a dominant influence over the character of the community" (Gumprecht, 2003, p. 51). J. B. Jackson, on the other hand, argues that we should look at everything in a landscape – including Relph's placeless places and Kunstler's scary places – because everything has meaning.

A well-known quote by Pierce Lewis (1983) describes the importance of landscape and place in humanistic geographical research:

> Give no preference to rural or to urban landscapes, modern or old, elite or ordinary, designed or undesigned. Human landscape is a document wherein cultures unwittingly reveal their present and their past in a kaleidoscopic array of things, patterns, and symbols. Before rushing to judge a landscape ugly or beautiful, pause and try to understand how it came to be, and what it says about the people who created it. There is intellectual stimulation everywhere for one who keeps eyes and mind open. There is beauty too. (Lewis, 1983, p. 248)

My research draws inspiration from humanistic approaches such as Florida, Gumprecht, Lewis, Jackson, Kunstler, and Relph. It is based primarily on a subjective and interpretive approach to reading the landscapes of the exurban periphery of Hattiesburg, Mississippi to better understand the processes of urban sprawl that are now occurring in South Mississippi. I examine the urban growth of Hattiesburg by hand-mapping landscape features both natural and human in origin as seen from an automobile. I call this technique drive-by geography because it involves studying the characteristics of the landscape through the windshield or windows of a vehicle while driving at a slow pace.

Data collection and field mapping from an automobile can be used to augment or as an alternative to GIS and remote sensing, which rely on aerial photography and satellite imagery to detect land use and land cover changes (Castilla, Guthrie, & Hay, 2009; Epstein, Payne, & Kramer, 2002; Srvivastava & Gupta, 2003; Yang, Xian, Klaver, & Deal, 2003). GIS and remote sensing approaches rely on imagery to decipher and

describe details about the landscape (Brown, Johnson, Loveland, & Theobald, 2005; Hepner & McKee, 1992; Pozzl & Small, 2005; Qlu, Woller, & Briggs, 2003; Wu, Huang, & Fung, 2009). For example, Weng (2002) studied land use change from industrialization and urbanization in an area of the Zhujiang Delta of China. "The techniques of satellite remote sensing and GIS are integrated to quantify and analyze land use and land cover changes using Landsat TM data and field surveyed *in situ* data" (Weng, 2002, p. 274). The study showed a notable growth in urban area and loss in cropland over a period of eight years. Xian and Crane (2005) use remote sensing data to assess urban growth in the Tampa Bay area. Using Landsat satellite data they determined the extent of urban growth through changes in impervious surfaces and found that it increased by approximately three-fold from 1991 to 2002 (Xian & Crane, 2005, p. 203).

Yang (2002) monitored the urban spatial growth of 13 counties in the Atlanta Metropolitan Area. "A time series of satellite images was used to trace the development of urban land uses for the period of 1973 to the present. An image processing and GIS-based method was developed to achieve the research goal. Results reveal that every week, more than one-hundred acres of forest, green space, and farmland in the Atlanta region were converted into urban uses" (Yang, 2002, p. 725). Epstein, Payne, and Kramer (2002) compared two methods of mapping suburban sprawl in Augusta, Georgia for accuracy assessment. Epstein, Payne, and Kramer (2002) utilized 1998 Thematic Mapper Data for a remote sensing approach to compare to a GIS based road network coverage. They found that their remote sensing approach took a shorter amount of time, but was less accurate than their GIS approach.

Quantitative approaches using GIS and remote sensing techniques typically analyze an area over a period of time whereas my approach looks at changes in the landscape during a single year. The acquisition of more details from an automobile, which I did for this thesis, illustrates the potential for humanistic and qualitative research (by qualitative I am referring to observational) to inform quantitative, geospatial approaches to the study of urbanization. My research is qualitative in the sense that it is based on my personal observations and perceptions of the landscape and the changes to it that are occurring from urbanization. It is, in a sense, an application of J.B. Jackson's and Relph's work on the importance of place.

This study is intended to locate on-the-ground evidence of landscape change associated with urban and exurban growth around Hattiesburg, Mississippi. I am using drive-by geography as a means to obtain data rather than relying upon remotely sensed imagery, which is the common method to analyze urban growth. I apply the Burgess Ring Model to the data I collect from surveying the landscape along roadways from inside an automobile. By placing my data into land-use categories and into the model I am able to see how the land-use changes from a perspective other than that used with GIS and remote sensing approaches. As such, the results of this study should provide an important amount of information to inform GIS and remote sensing approaches to the study of urbanization due to the firsthand knowledge I gained about land-use changes.

Study Area

The geographical extent of my research encompasses the roads and highways between the communities of Columbia, Hattiesburg, Lumberton, Purvis, and Sumrall, Mississippi, all of which are located in Forrest, Lamar, and Marion counties in South

Mississippi (Figure 1). The communities of Columbia, Hattiesburg, Purvis, and Sumrall, Mississippi mark the extent of my study area within these three counties.

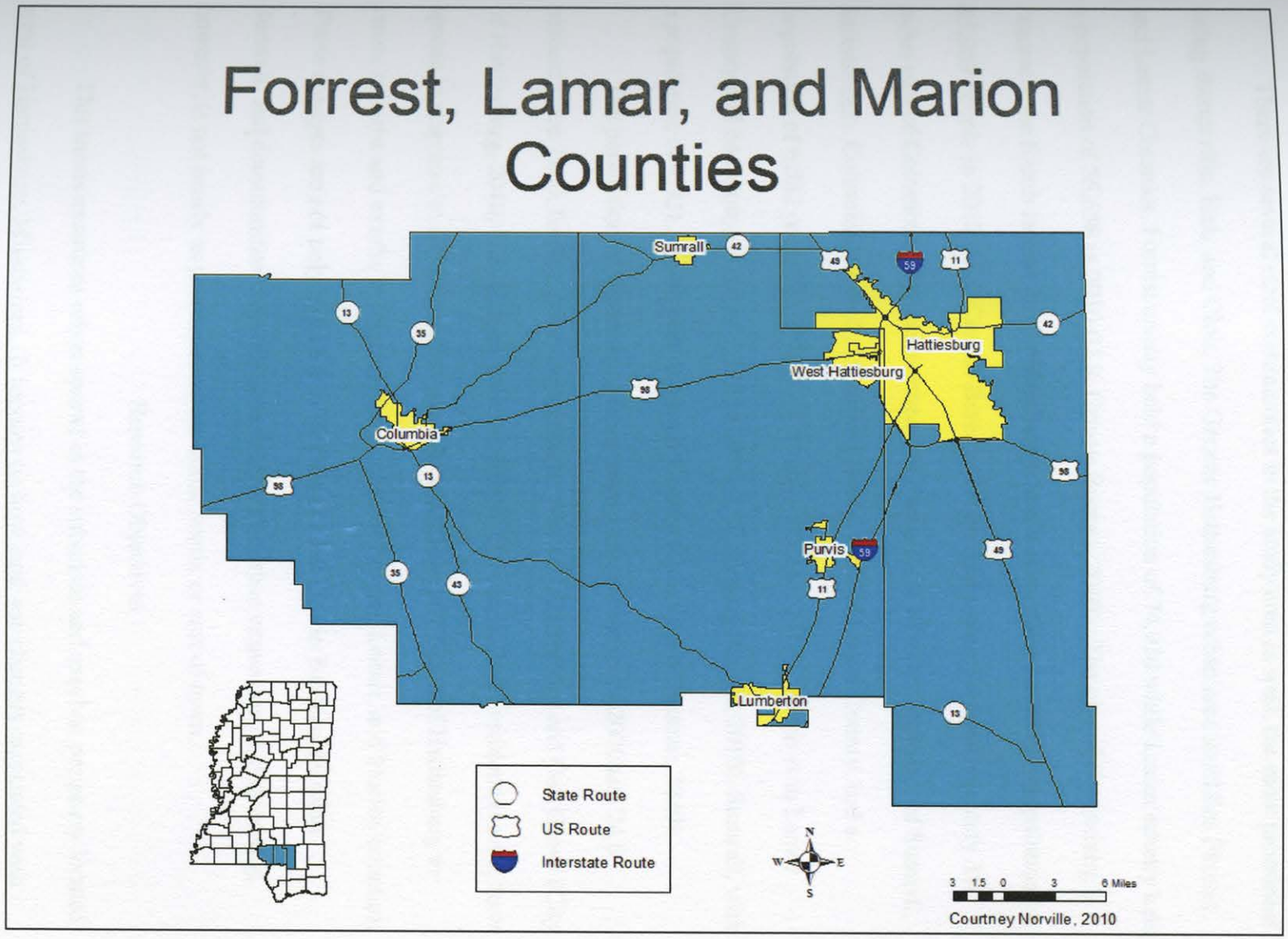

Figure 1. Map of the Study Area (Courtney Norville, 2010).

There are several rural communities in the study area as well, the most prominent being Baxterville, Hub, and Oloh. The Greater Hattiesburg urban area straddles Forrest and Lamar Counties. Forrest county held a population of 74,934 while Lamar county held a population of 55,658 in 2010 (U.S. Census Bureau, 2010). The city of Hattiesburg is currently the fourth largest city in Mississippi and was estimated to have a population of 45,989 people in 2010 (U.S. Census Bureau, 2010). Hattiesburg is approximately 35 miles east of Columbia, 15 miles northeast of Purvis, and 18 miles southeast of Sumrall, Mississippi. Columbia, located in Marion County, west of Lamar County, had a population of 6,582 people in 2010 (U.S. Census Bureau, 2010). Purvis is in Lamar County and had a population of 2,175 in 2010 (U.S. Census Bureau, 2010). Sumrall, with a population of 1,421, is also part of Lamar County (U.S. Census Bureau, 2010).

The population of Hattiesburg has grown 16.0 percent since 2000 and 24.0 percent since 1990, fueling urban expansion in Western Hattiesburg and Oak Grove (City of Hattiesburg, 2010; U.S. Census Bureau, 2010). Commercial and residential areas have spread in response to this population growth beyond the city limits of Hattiesburg to create suburbs and exurbs in formerly rural areas of Forrest, Lamar, and Marion counties. These changes are not only apparent in Oak Grove, but also in Baxterville, Oloh, Sumrall, and communities west of Hattiesburg. The urban expansion of Hattiesburg, however, is not nearly as prominent to the north, south, or east of town.

Research Objectives

This thesis examines urban sprawl in the suburban and exurban periphery located west of Hattiesburg, Mississippi. It focuses on how land-use changes associated with urbanization are perceived from an automobile using drive-by geography. My research

involves collecting data from an automobile to identify details that might not be visible from aerial photography or satellite imagery due to vegetation and other obstructions, or simply because its perspective is from above rather than on the ground. The research activities and analysis used for this thesis are unique because no one has applied these research methods to such a large study area as I have applied them to and the results I acquired through these activities are expected to be of use to GIS and remote sensing studies of urbanization. More importantly they are meant to provide a template to analyze urbanization both with qualitative and quantitative methods.

The goal of this research is to answer the following questions:

- What aspects of land-use change can be seen from an automobile in Forrest, Lamar, and Marion counties of South Mississippi?
- Where is urbanization and exurban growth associated with Hattiesburg transforming the landscapes of Forrest, Lamar, and Marion counties?
- How can data collection from an automobile be used to inform GIS and remote sensing approaches to land-use change?

Expected Results

My research provides a layer of contextual detail that I believe is not possible with remote sensing alone. There are a handful of results that I expect to unfold from this research. I expect to find several land-use features distributed throughout the urban, suburban, exurban, and rural areas of my study such as pasture, cropland, trailers, and houses. I believe that my results will show a definite relationship between urbanization and proximity of cities to Hattiesburg. I expect to see a difference in the distribution of landscape features to the north versus to the south of Highway 98. I expect to determine

that more details can be gained from an automobile perspective compared to that of satellite data by juxtaposing hand-mapped data with Landsat 7 ETM+ imagery. I expect the Burgess Model will show landscape features distributed relative to urban, suburban, exurban, and rural areas. Lastly, I expect the Point Density Analysis to verify the results of the Burgess Model.

Organization of the Thesis

This thesis is organized into three chapters following this introduction. Chapter II explains my three research activities and the methods I used to answer my research questions. My primary research activities included road transects from which I produced a wealth of field notes, digital photographs, GPS points, and sketched hand-drawn maps. I then digitally convert my hand-drawn maps into ArcGIS shapefiles to produce maps of each land-use category and a map of my study areas landscape characteristics. I will use the ArcGIS shapefiles to digitally overlay onto Landsat imagery in order to show the difference in detail available between the two sources. Chapter III contains and summarizes the results of these three types of research activities. My results will include selected narratives of two routes to explain the experience of driving them and observing their landscapes. I will use the Burgess Ring Model on the ArcGIS shapefiles of landscape characteristics that I create in order to visualize where urbanization and exurban growth is transforming the landscapes around Hattiesburg. I will then use a spatial analyst tool called Point Density to calculate the magnitude of point features within a given area to visualize the spatial patterns of the landscape characteristics within my study area. Lastly, Chapter IV summarizes my research and its results and discusses its relevance to urban geography.

CHAPTER II

METHODOLOGY

The three research questions I used for this thesis revolved around aspects of land-use change; the location of urbanization and exurban growth relative to landscape change; and how these data, when collected from an automobile could inform GIS and remote sensing analysis of land-use change. I decided to undertake an alternative approach to land use/land-cover change research by using drive-by geography as my primary research activity and the acquisition of satellite imagery as my subsidiary activity. As detailed in Chapter I, I came up with the term, drive-by geography, to refer to the unique type of research I conducted, which consisted of traveling down 45 rural roads and highways and hand-mapping landscape characteristics from inside the vehicle.

My thesis is based on three primary research activities that I completed between May 2009 and May 2010. First, I conducted transects along 45 routes between the cities of Columbia, Hattiesburg, Purvis, and Sumrall (Table 1 and Figure 2). While conducting these transects, I took field notes, digital photographs, GPS points, and sketched hand-drawn maps of each route to observe the impacts of urban and exurban sprawl on the landscape. Second, I converted the hand-drawn maps into ArcGIS shapefiles for digital interpretation and analysis. Third, I used ArcGIS to overlay the shapefiles onto Landsat imagery for subsequent interpretation and comparison with my transect field documents. In the following sections, I describe each of these research activities in detail.

Transects

I conducted transects by automobile along 45 selected routes that link Columbia, Hattiesburg, Purvis, and Sumrall (Table 1 and Figure 2). I used the Burgess Model, an

urban land use model that divides cities into concentric circles from the urban center to its suburbs and development continues, and the *Mississippi Gazetteer* to choose transportation routes between these communities (DeLorme, 2007; Short, 1984). The Burgess Model is not commonly used by geographers but I choose it due to familiarity and the purposes of this research. I used Hattiesburg as my city center and placed concentric rings out towards Columbia in order to choose my transportation routes. I then applied the Burgess Model to classify these routes as either urban, suburban, exurban, or rural in nature (Short, 1984). At the core of the Burgess Model is the central business district (CBD) with the first outer ring representing suburbs and peripheral rings for exurban and rural areas. The transportation network of my study area provides an excellent framework to examine the spatial dimensions of urban growth from the perspective of an automobile. By driving these routes, I essentially conducted transects across the metropolitan region of Hattiesburg through which I could visually interpret the character of urban growth.

Table 1

Roads and Highways in the Study Area

ROUTES NORTH OF HIGHWAY 98	ROUTES SOUTH OF HIGHWAY 98
Atwood Road	A. J. Bond Road
Christian Union Road	Arena Road
Foster Road	Baxterville-Purvis Road
Highway 42	Bay Creek Road
Highway 44	Brushy Creek Road
Highway 589 North	Caney Church Road
Improve Road	Doc Johnson Road
J.C. Riley Road	E. Baylis Chapel Road
N. Mill Creek Road	Game Reserve Road
Old Highway 24 North	Haden Road
Old Salt Road	Highway 13
Oloh Road	Highway 589 South
Oral Church Road	J. D. Broome Road
Patterson Road	Johnson Road
Pierce Road	Knight Road
Rocky Branch Road	Lampton Hilltop Road
Scruggs Road	Lookout Tower Road
	Luther Lee Road
	Luther Saucier Road
	Midway Church Road
	Old Highway 11
	Old Highway 24 South
	Pine Burr Road
	Prosperous Ridge Road
	Purvis-Oloh Road
	Purvis-Columbia Road
	Sistrunk Road
	Tatum Salt Dome Road

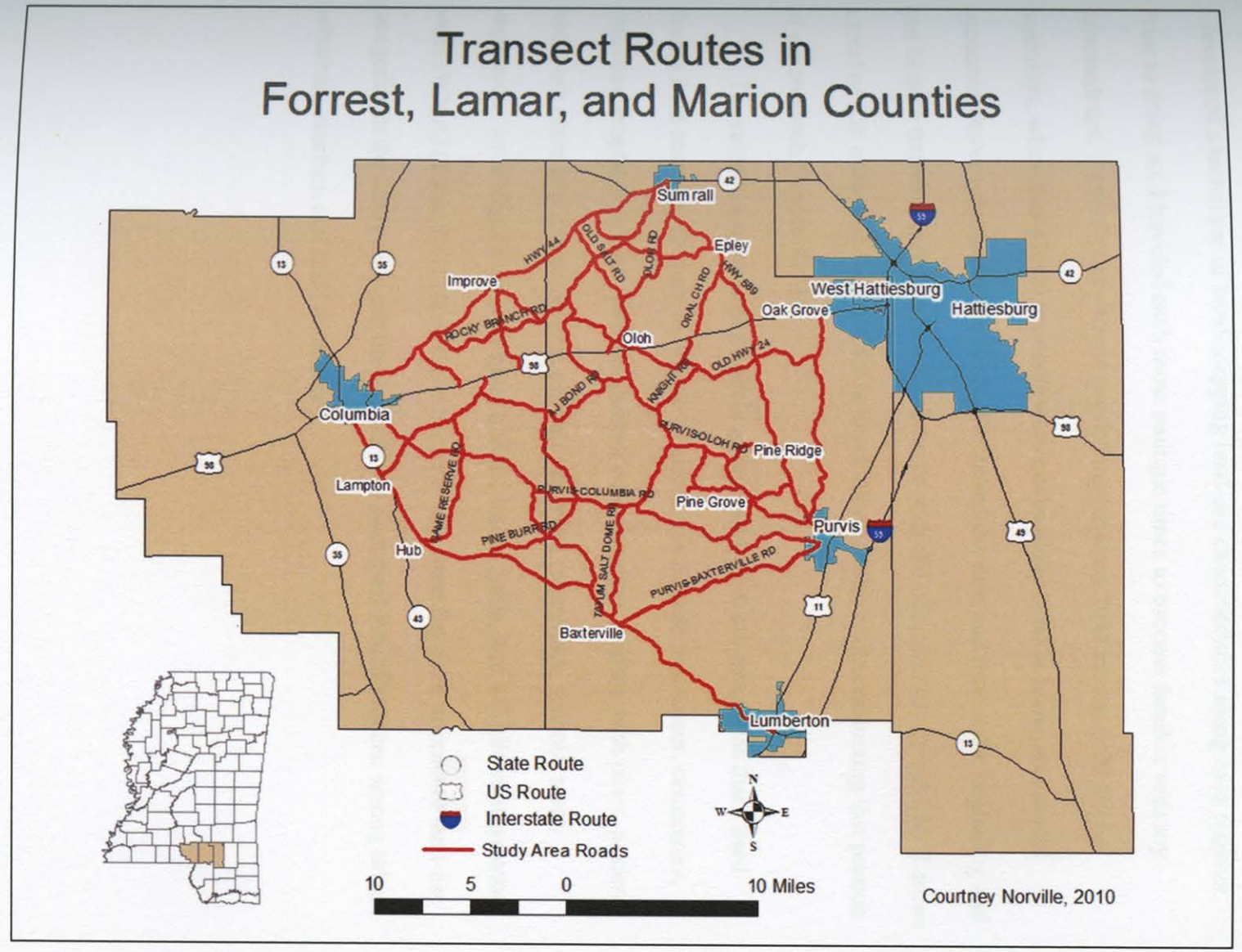

Figure 2. Transects of Forrest, Lamar, and Marion Counties (Courtney Norville, 2010).

To better understand the character of urban growth in the greater Hattiesburg area I developed a technique of hand-mapping land-use characteristics along each transect. Prior to doing so, I traveled each route multiple times to become familiar with my surroundings. I intentionally timed my driving between 7:00 am and 6:00 pm on weekdays, when many local residents were not as likely to be at home, so I would encounter fewer vehicles on the roads. I recorded the date and time at the beginning and end of each transect, and documented distance with the odometer of my vehicle. I drove a total of 356 miles and logged 26.9 hours of driving time while conducting this portion of my research (Appendix A).

I developed a system of symbols to represent land-use categories that I used during field mapping (Figure 3). These 17 categories include businesses, cemeteries, churches, cropland, houses, pasture, pasture with livestock, pasture with pines, pasture with both pines and livestock, pine plantations, retail complexes, schools, scrub vegetation, scrub vegetation with pine, trailers, trailer parks, and wildlife management areas (WMA) (Table 2). I chose these because they were the most prominent land-use categories in the study area and they effectively portrayed the differences among urban, suburban, exurban, and rural landscapes.

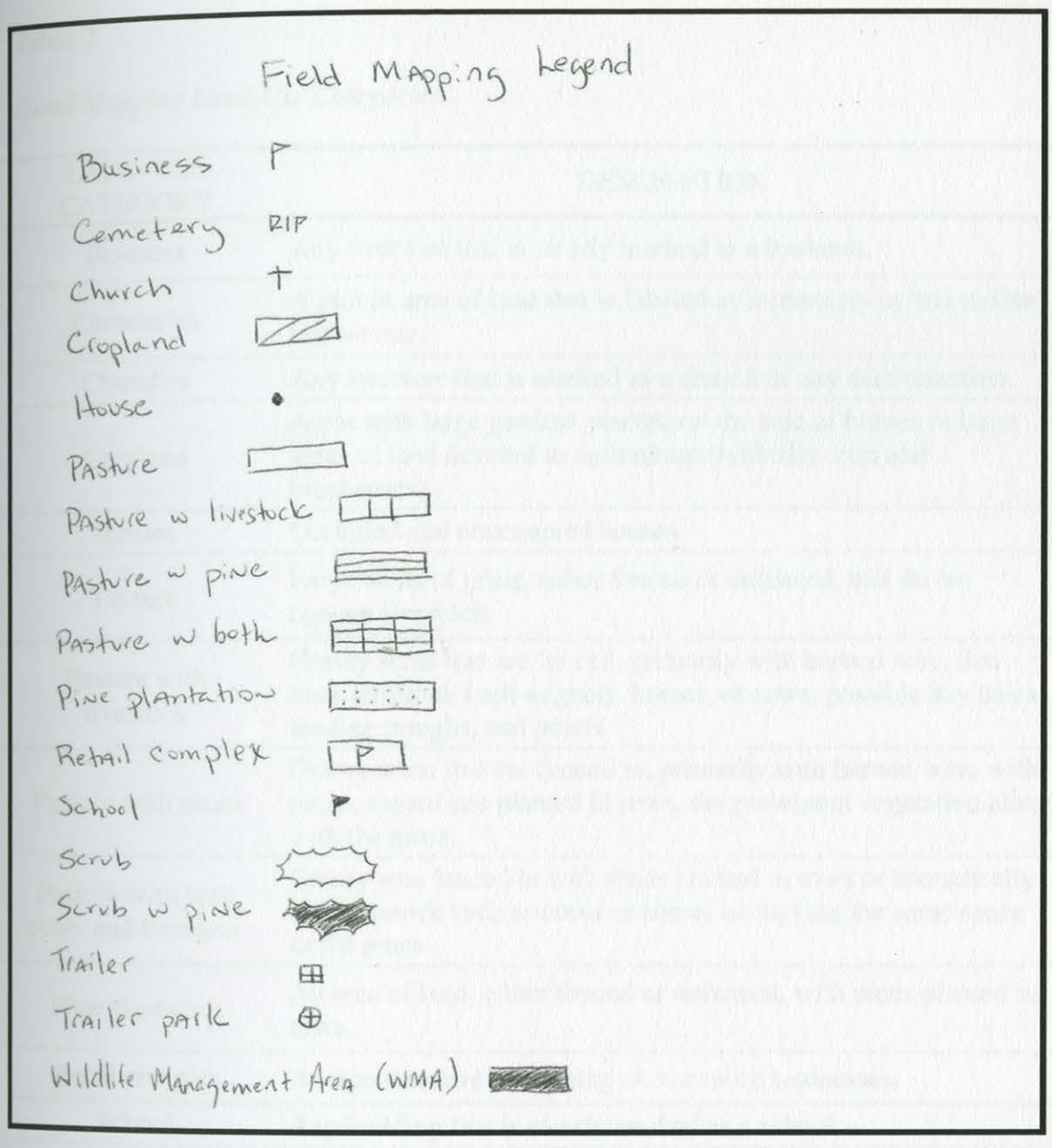

Figure 3. Hand-drawn legend used to map landscape categories (Courtney Norville, 2010).

Table 2

Hand Mapping Land-Use Categories

LAND-USE CATEGORY	DESCRIPTION
Business	Any structure that is clearly marked as a business.
Cemeteries	A plot or area of land that is labeled as a cemetery or has visible tombstones.
Churches	Any structure that is marked as a church of any denomination.
Cropland	Areas with large gardens planted on the side of homes or large areas of land devoted to agriculture (typically corn and blueberries).
Houses	Occupied and unoccupied houses.
Pasture	Large areas of grass, either fenced or unfenced, that do not contain livestock.
Pasture with livestock	Grassy areas that are fenced, primarily with barbed wire, that have livestock such as goats, horses, or cows, possible hay bales, feeding troughs, and ponds.
Pasture with pines	Grassy areas that are fenced in, primarily with barbed wire, with pines, sometimes planted in rows, the prominent vegetation along with the grass.
Pasture with both pines and livestock	Grassy area fenced in with pines planted in rows or sporadically and livestock such as cows or horses occupying the same space as the pines.
Pine plantation	An area of land, either fenced or unfenced, with pines planted in rows.
Retail complex	A large structure containing two or more businesses.
School	Any building that is clearly marked as a school.
Scrub	Areas of vegetation growing wild along the roadside.
Scrub with pine	An area of vegetation growing wild with pine trees being the most prominent species.
Trailer	Any trailers that are not in a trailer park.
Trailer park	Areas where there are five or more trailers in close proximity to each other and a possible sign specifying an area as a trailer park.
Wildlife Management Area (WMA)	Area of land that provides refuge for nongame species and public hunting of game species.

I hand-mapped the land-use characteristics of each transect between Columbia, Hattiesburg, Purvis, and Sumrall using my land-use categories, my land-use symbols, a notebook, and pencils while I drove each of the forty-five routes at a speed of about twenty to thirty miles per hour. This involved paying close attention to the landscape outside the window of my automobile, as well as to other vehicles on the road. I had to pull over many times to let cars pass so I could capture as much of the landscape as possible in my hand maps. This hand-mapping activity produced a series of landscape base maps that I then converted to digital files to create a digital map using ArcGIS 9.3 software (Figures 4 to Figure 8). The limitations to the data collected are that they only cover what could be seen from the vehicle windows or roadside. They are also temporal, and thus have no fixed categories as land-use features. I recorded global position system (GPS) points of any house, trailer, or business along each transect, respecting the privacy of local residents by capturing GPS points from the road. I then used these points to verify the location of the hand-mapped land-use characteristics in ArcGIS.

In addition to hand mapping, I also took digital photographs at the beginning and end, as well as every two miles along each transect. These digital photos covered a 360 degree swath to provide a full field of view at each location, and also to aid in visualizing the experience from the perspective of an automobile. I have included a set of digital photos taken of A. J. Bond Road as an example of this process (Figures 9 to Figure 16). I took these photos at the intersection of A. J. Bond Road and J. D. Broome Road (Figure 17). I then used Autostitch, a free software package to stitch these digital photos together to create a panoramic mosaic of the intersection (Figure 18).

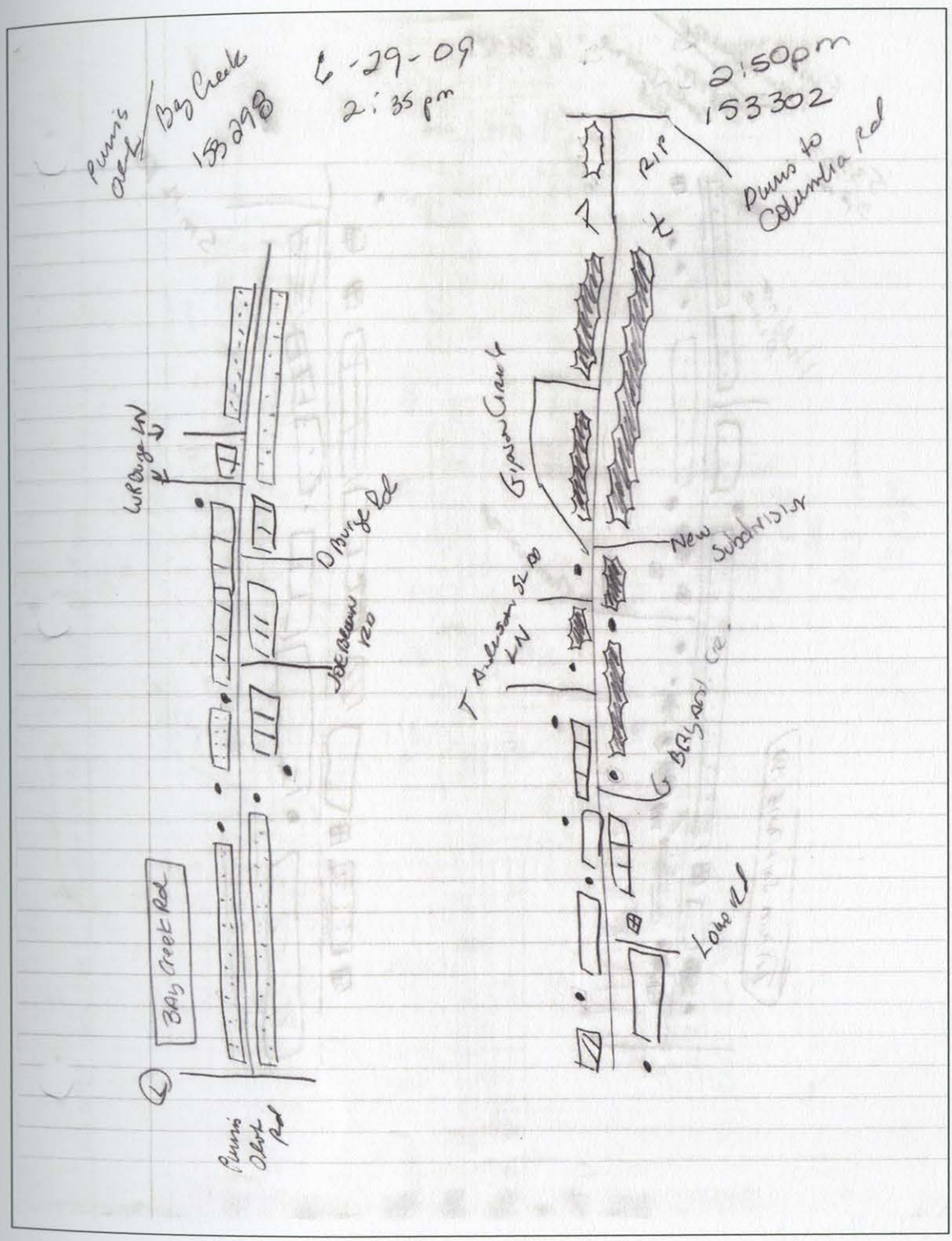

Figure 4. Bay Creek Road Hand Map (Courtney Norville, 2010).

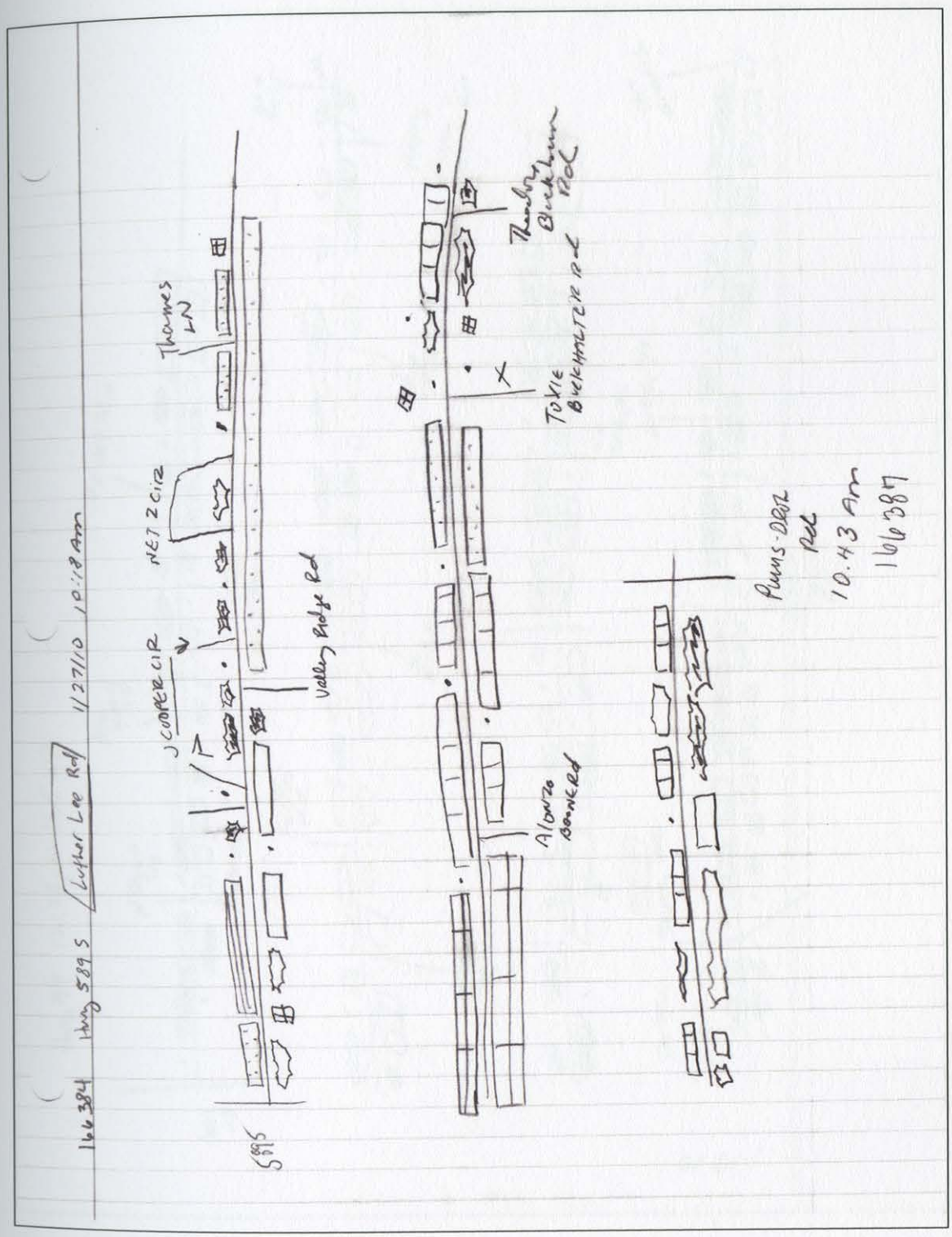

Figure 5. Luther Lee Road Hand Map (Courtney Norville, 2010).

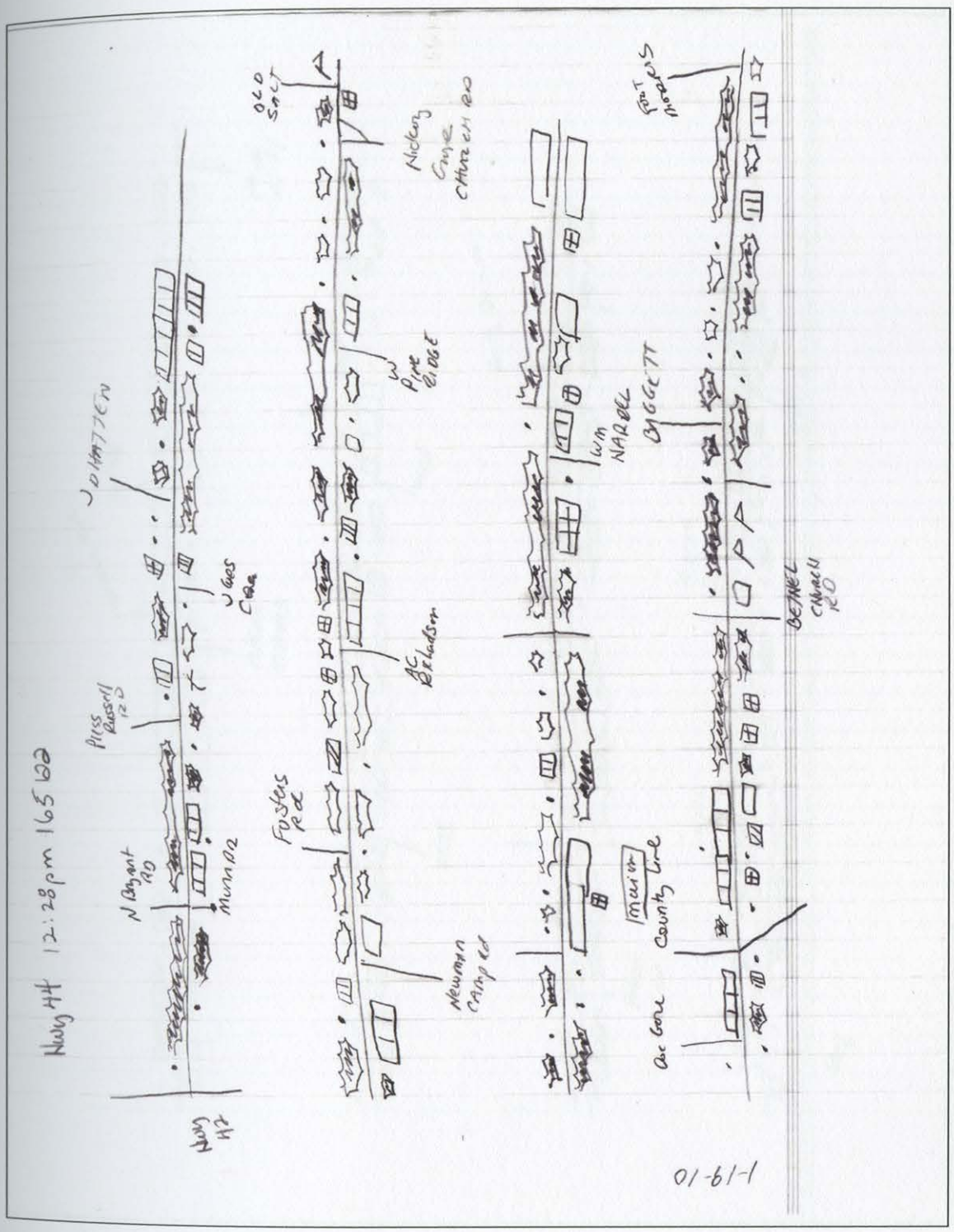

Figure 6. Highway 44 Hand Map (Courtney Norville, 2010). Figures 7-8 are a continuation of Highway 44 Hand Maps.

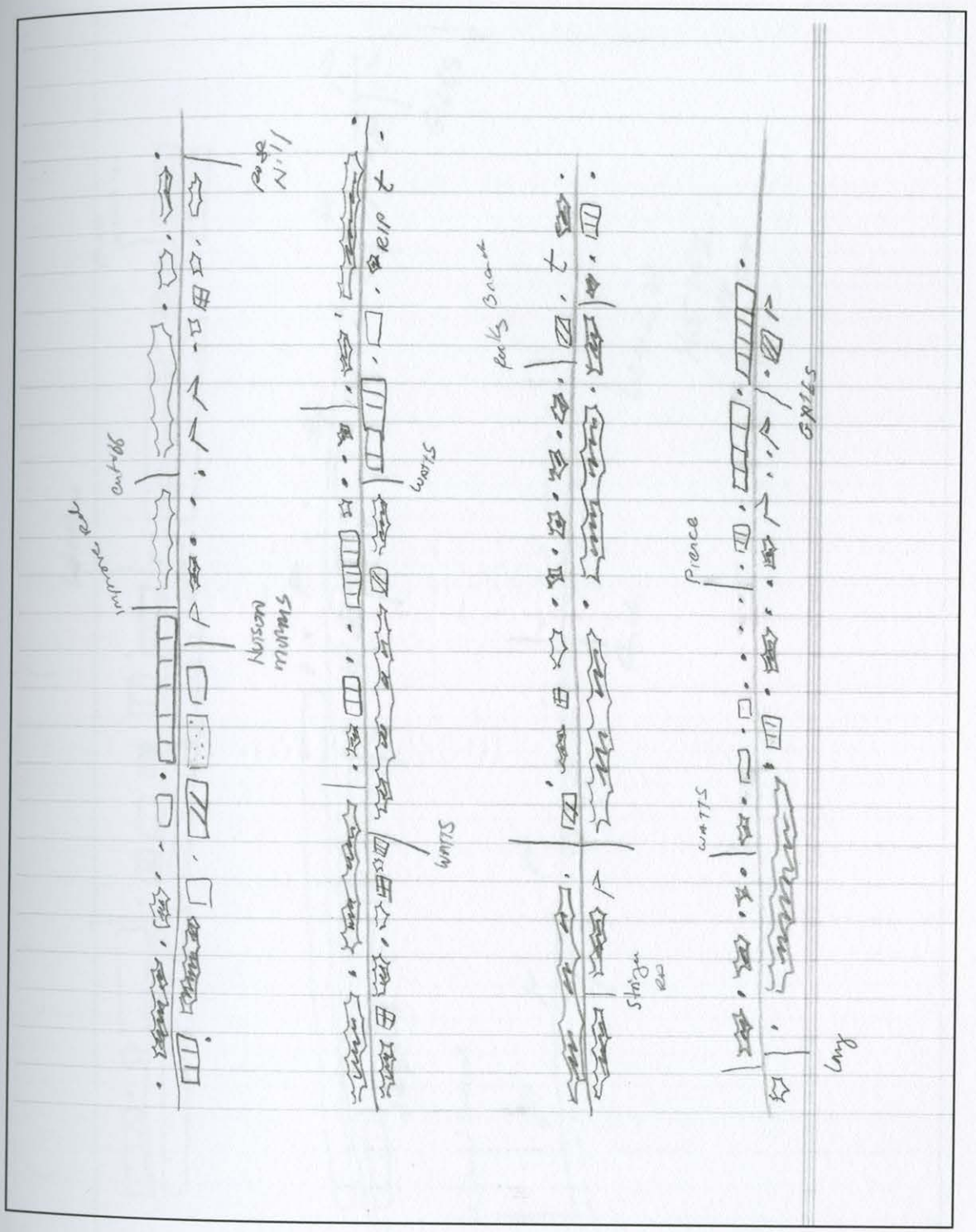

Figure 7. Highway 44 Hand Map (Courtney Norville, 2010).

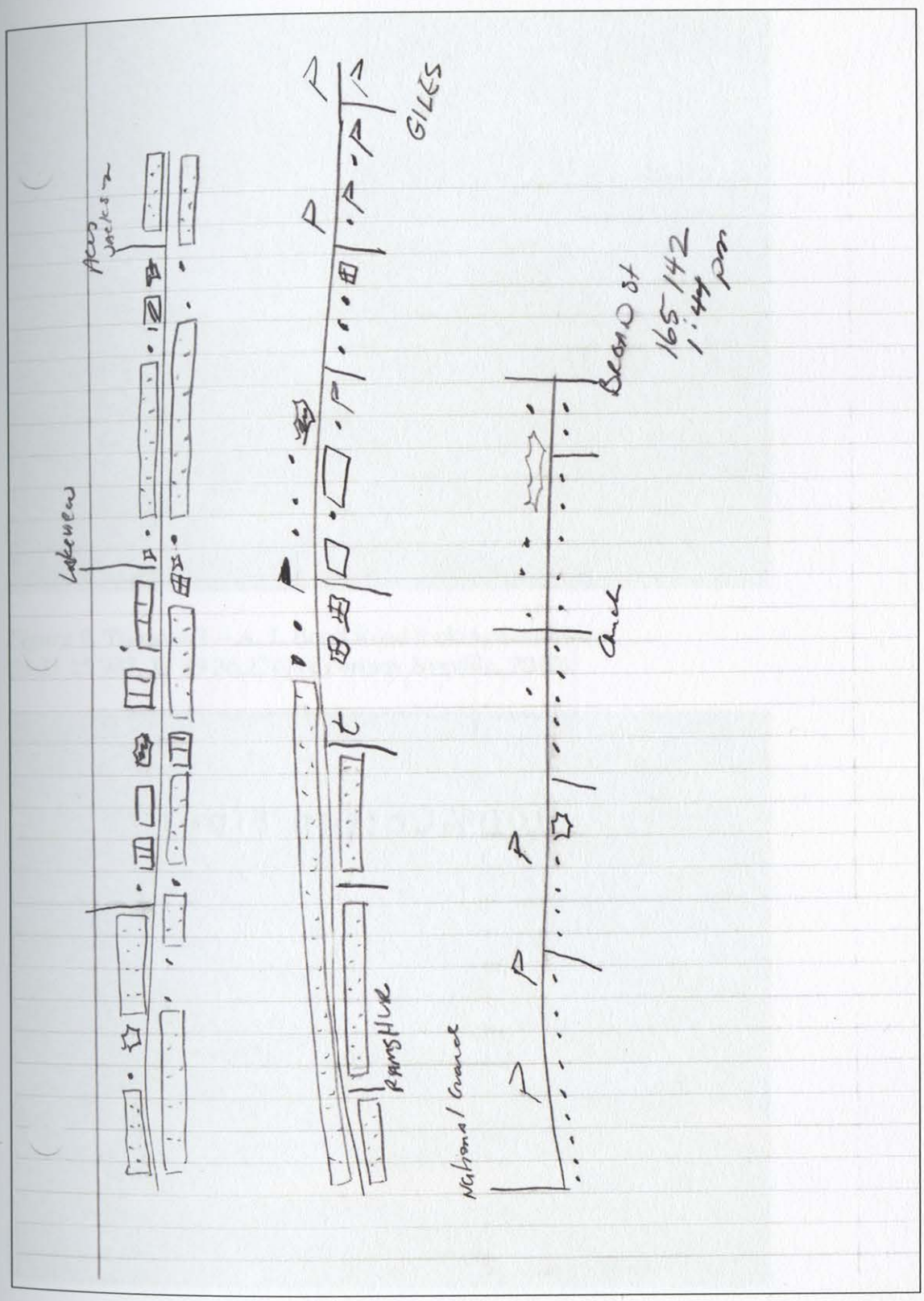

Figure 8. Highway 44 Hand Map (Courtney Norville, 2010).

Figure 9 Transect 1 – A. J Bond Road looking Southwest, (N 31 15 987, W 89 36.274) (Courtney Norville, 2010)

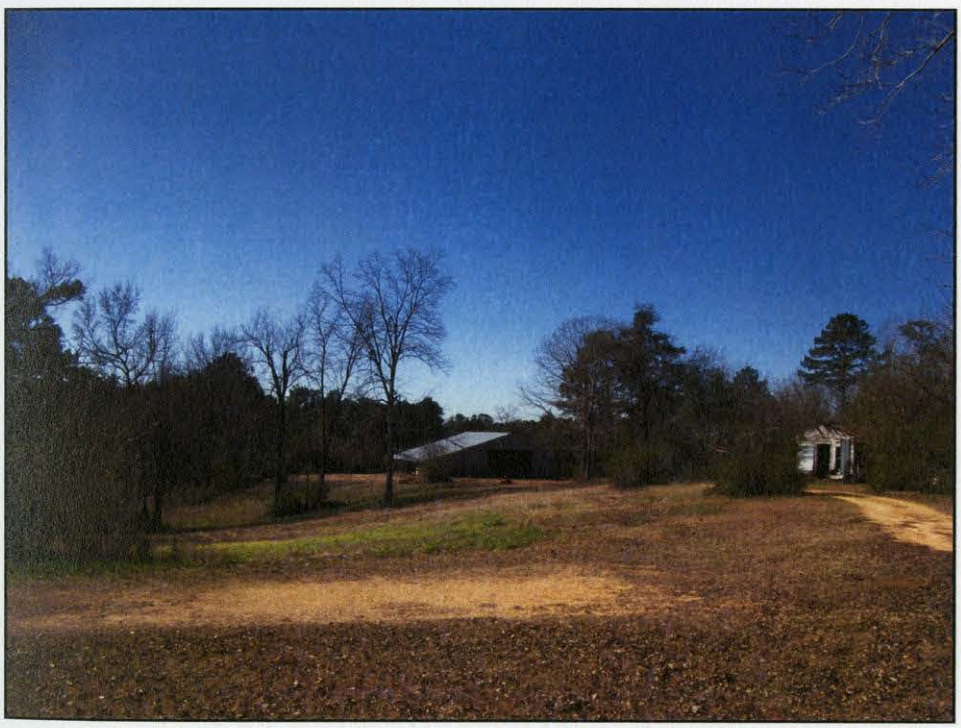

Figure 10. Transect 1 – A. J Bond Road looking West, (N 31 15 987, W 89 36.274) (Courtney Norville, 2010).

Figure 11 Transect 1 – A. J. Bond Road looking Northwest, (N 31 15 987, W 89 36.274) (Courtney Norville, 2010)

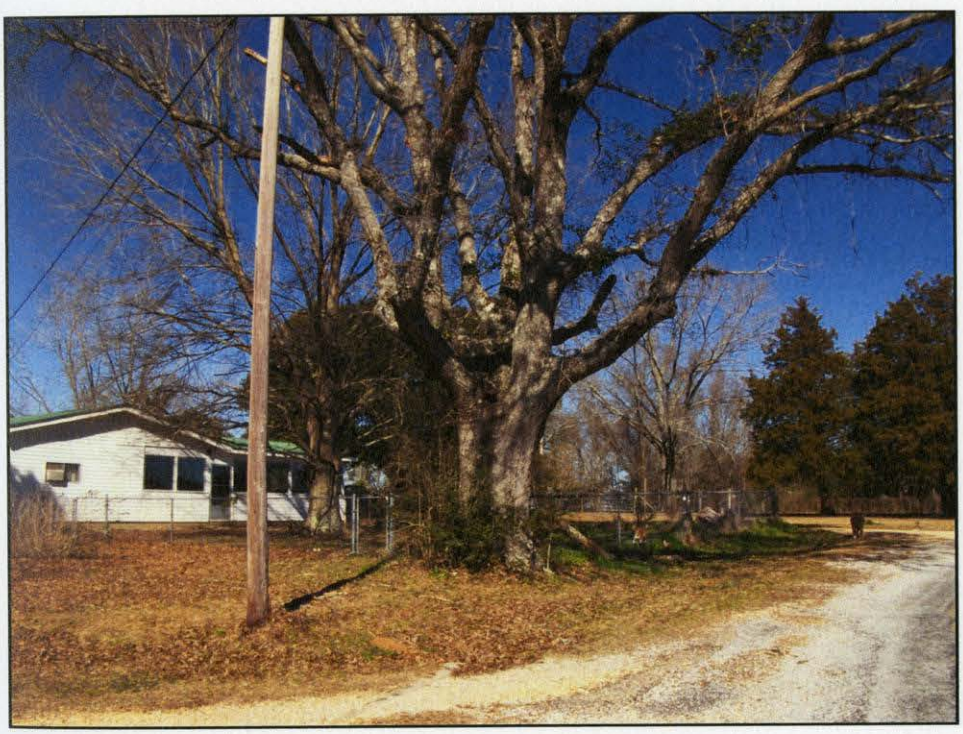

Figure 12 Transect 1 – A. J Bond Road looking North, (N 31 15 987, W 89 36.274) (Courtney Norville, 2010)

Figure 13 Transect 1 – A. J Bond Road looking Northeast, (N 31 15.987, W 89 36.274) (Courtney Norville, 2010).

Figure 14. Transect 1 – A. J Bond Road looking East, (N 31 15 987, W 89 36.274) (Courtney Norville, 2010).

Figure 15 Transect 1 – A. J Bond Road looking Southeast, (N 31 15 987, W 89 36.274) (Courtney Norvılle, 2010).

Figure 16. Transect 1 – A. J Bond Road looking South, (N 31 15.987, W 89 36.274) (Courtney Norvılle, 2010)

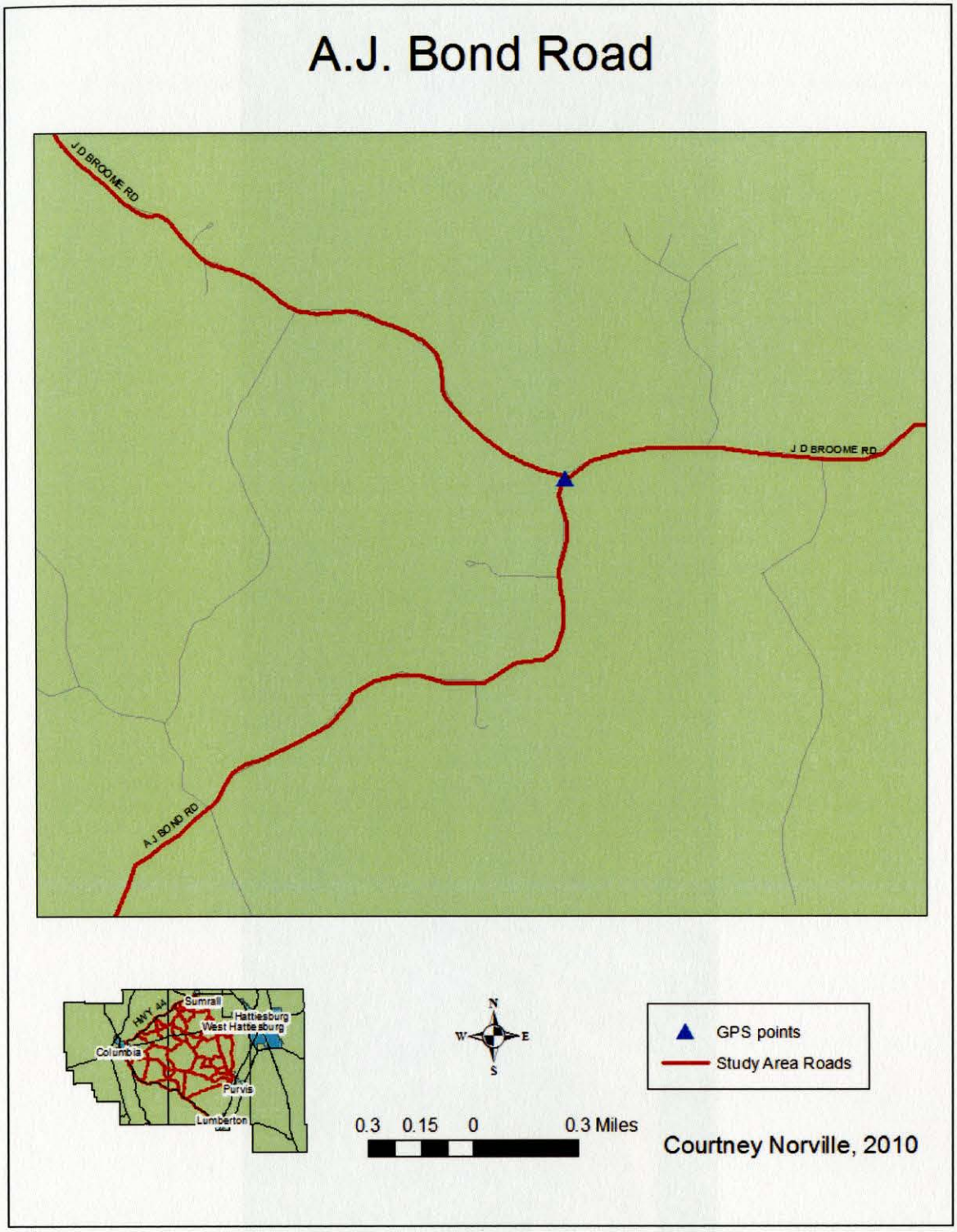

Figure 17 Figures 8-15 are photos of the point on A.J Bond Road represented on the above map (N 31 15 987, W 89 36.274) (Courtney Norville, 2010)

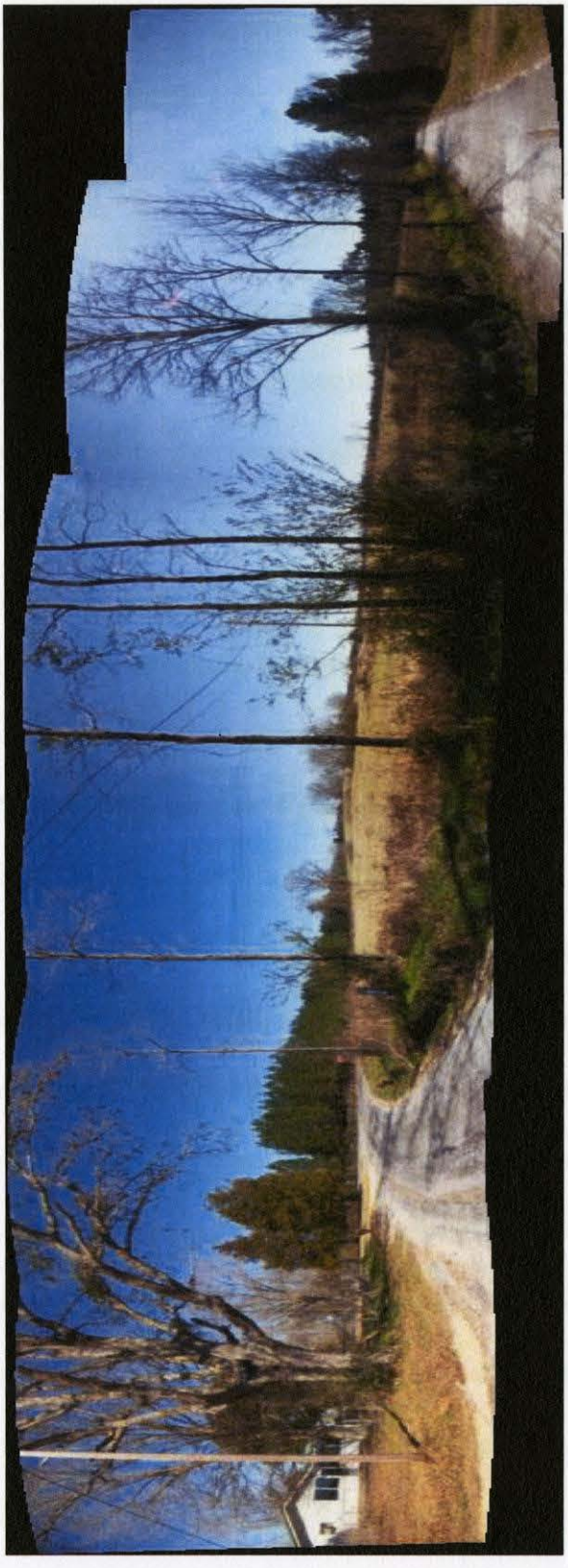

Figure 18. A. J Bond Road Panoramic View (Courtney Norville, 2010)

Digital Conversion in ArcGIS

I created shapefiles in ArcGIS 9 3 to produce a map of urban sprawl in the study area. These shapefiles are based on various composite data sets, such as TIGER/Line shapefiles from the U.S Census Bureau for standard county-level data from MARIS (Mississippi Automated Resource Information System), which I have found to be an invaluable repository for a variety of publicly available data related to Mississippi (MARIS 2010) The data contains street names and locations and various common layers such as county borders, roads, railroads, and census places for the three counties. I digitized the hand-mapped features of the landscape over the county border and road layers to create a shapefile for each land-use category, except for the pine plantation and scrub with pine categories. For these two categories, I created a single shapefile (Pines), which incorporates both pine plantations and pine scrub lands.

I created a total of sixteen shapefiles from the hand-mapped data that included businesses, cemetery, church, cropland, houses, pasture, pasture and livestock, pasture and pines, pines, pines and livestock, retail complex, schools, scrub, trailers, trailer parks, and wildlife management areas (WMA) I have provided maps of each shapefile to show their extent along all 45 transects (Figures 19 to Figure 29) In some cases, I combined shapefiles of similar landscape categories because they can be typically found in the same location. For example, I created one map for businesses and retail complexes. From these six original maps I created a single map that includes all landscape categories. Given the complexity of this map, I divided it into six sections to make it more readable and created a reference guide map (Figures 30 to Figure 36) I also created a shapefile containing the 75 GPS points I collected in order to verify the hand-mapped land-use

characteristics (Figure 37) I collected these points using a Garmin Geko 101 unit. This particular GPS device is not capable of downloading data to a computer so I had to manually enter each point into a spreadsheet using Microsoft Excel, using its latitude and longitude in order to create the shapefile of the GPS points.

Digital Overlay

I used Landsat Thematic Mapper ™ 2002-2003 imagery, acquired from MARIS, of Forrest, Lamar, and Marion counties in ArcGIS to compare to my hand-mapped land-use characteristics (Figure 38 and Figure 39). The shapefiles I created for each land-use category and the GPS points are overlaid onto the satellite imagery to produce a comprehensive representation of urban, suburban, exurban, and rural landscapes.

The method I used to examine the urban growth of Forrest, Lamar, and Marion counties is different from typical land use/land-cover change research, which relies on aerial photography, satellite imagery, and quantitative methods for interpretation with ground-truthing as an auxiliary activity (Castilla et al., 2009; Epstein et al., 2002, Srvivastava & Gupta, 2003, Yang et al., 2003) Traditional remote sensing approaches identify features by descriptors such as shape or spectral characteristics. Areas of uncertainty were ground truthed to aid in interpretation of land use/land-cover Techniques relying on aerial photography and satellite imagery are used to observe large areas in short amounts of time and to describe characteristics of a landscape in place of written descriptions such as narratives or hand maps. My approach is more hands-on and time consuming, but it yields a lot of detail about landscapes that would have been impossible to obtain using standard satellite image processing methods.

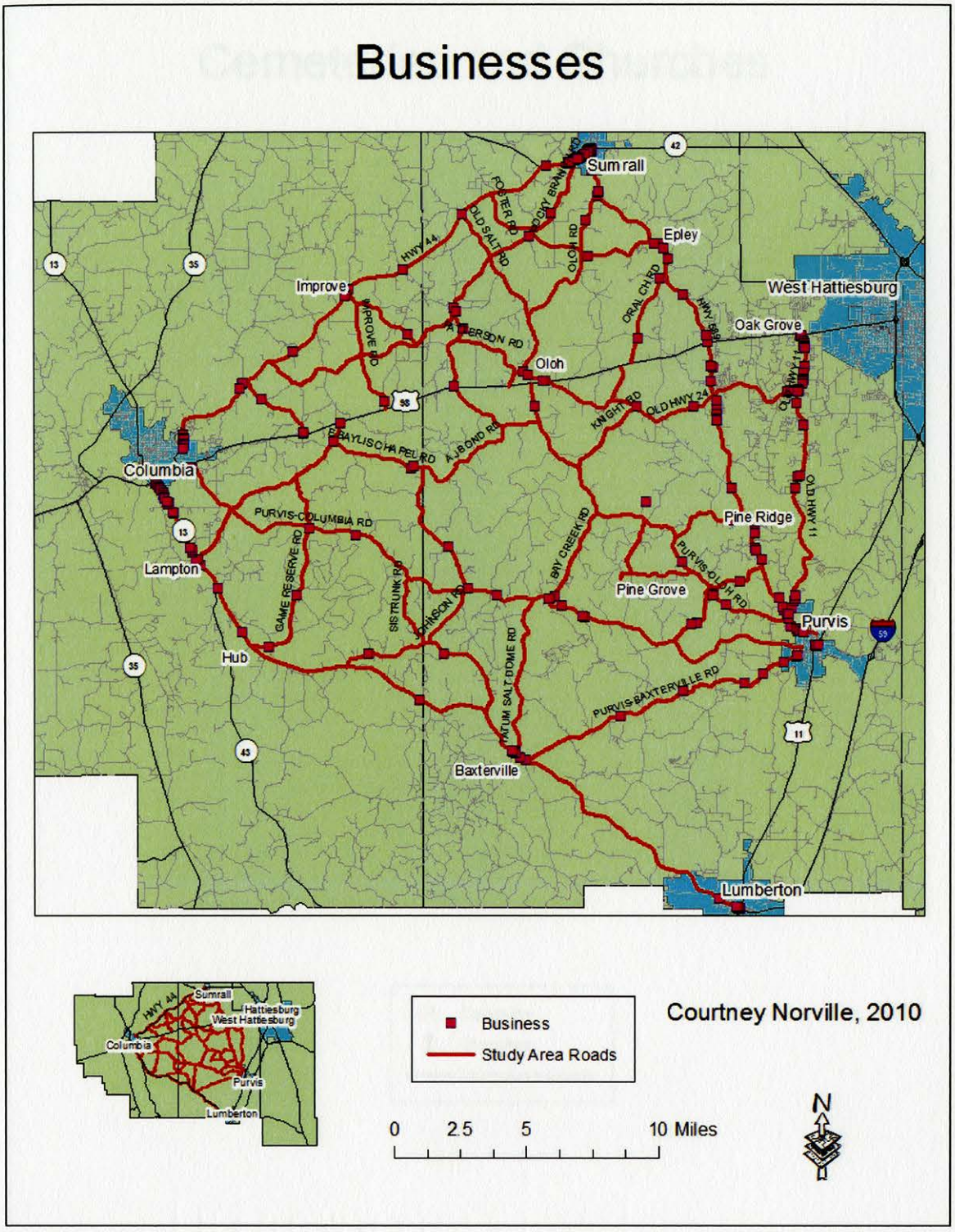

Figure 19 Map of Businesses and Retail Complexes Based on Hand-Drawn Maps (Courtney Norville, 2010)

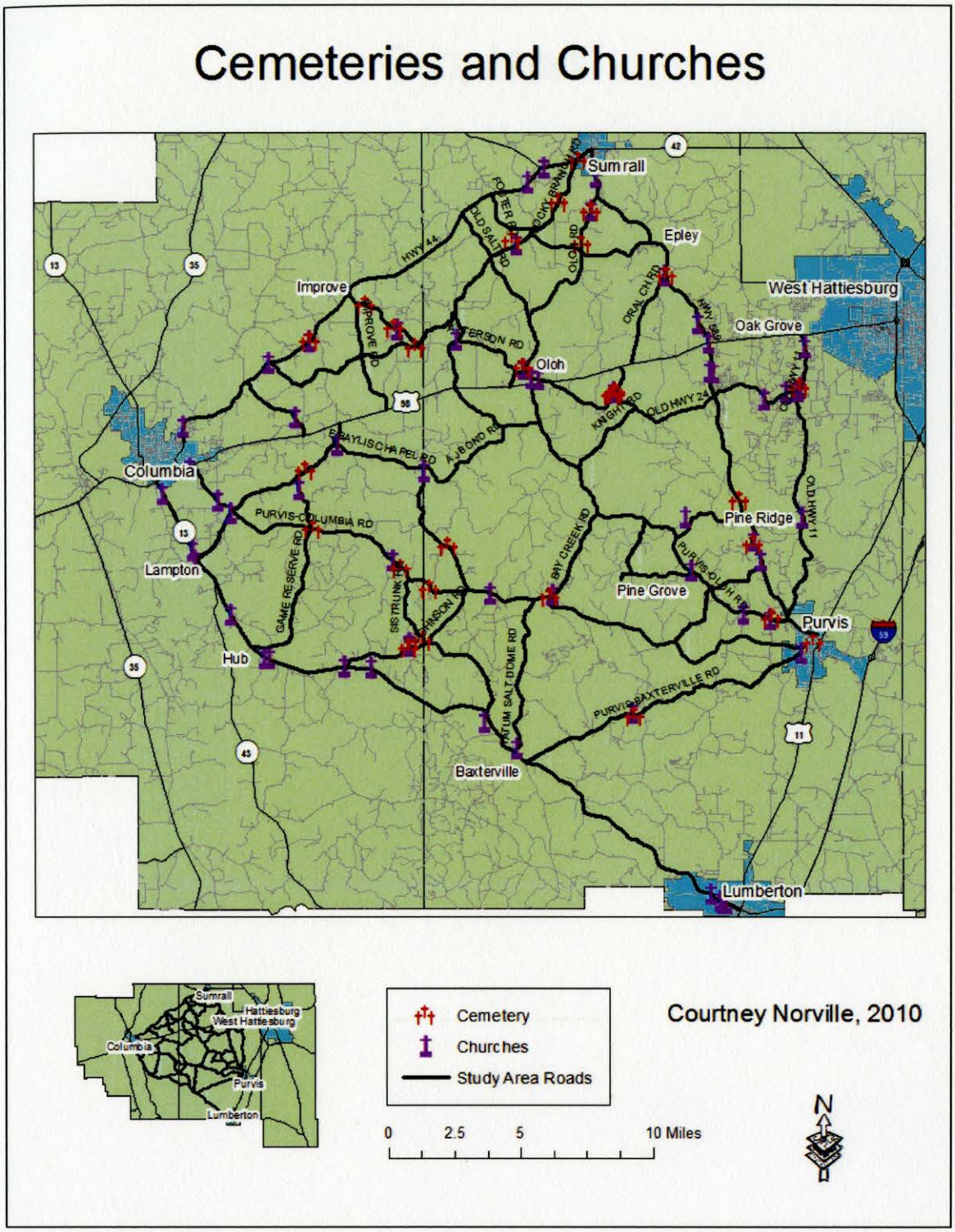

Figure 20. Map of Cemeteries and Churches Based on Hand-Drawn Maps (Courtney Norville, 2010)

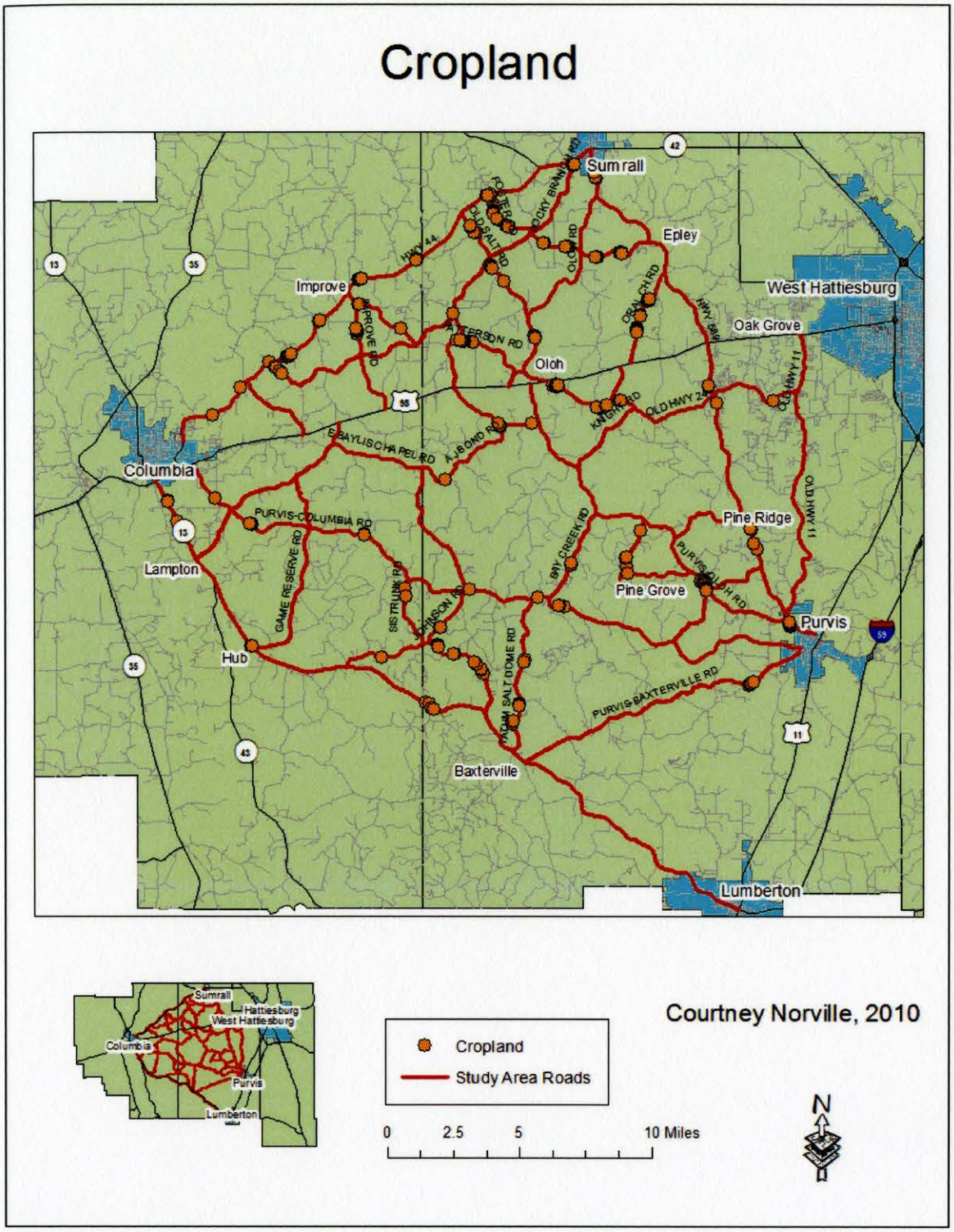

Figure 21 Map of Cropland Based on Hand-Drawn Maps (Courtney Norville, 2010).

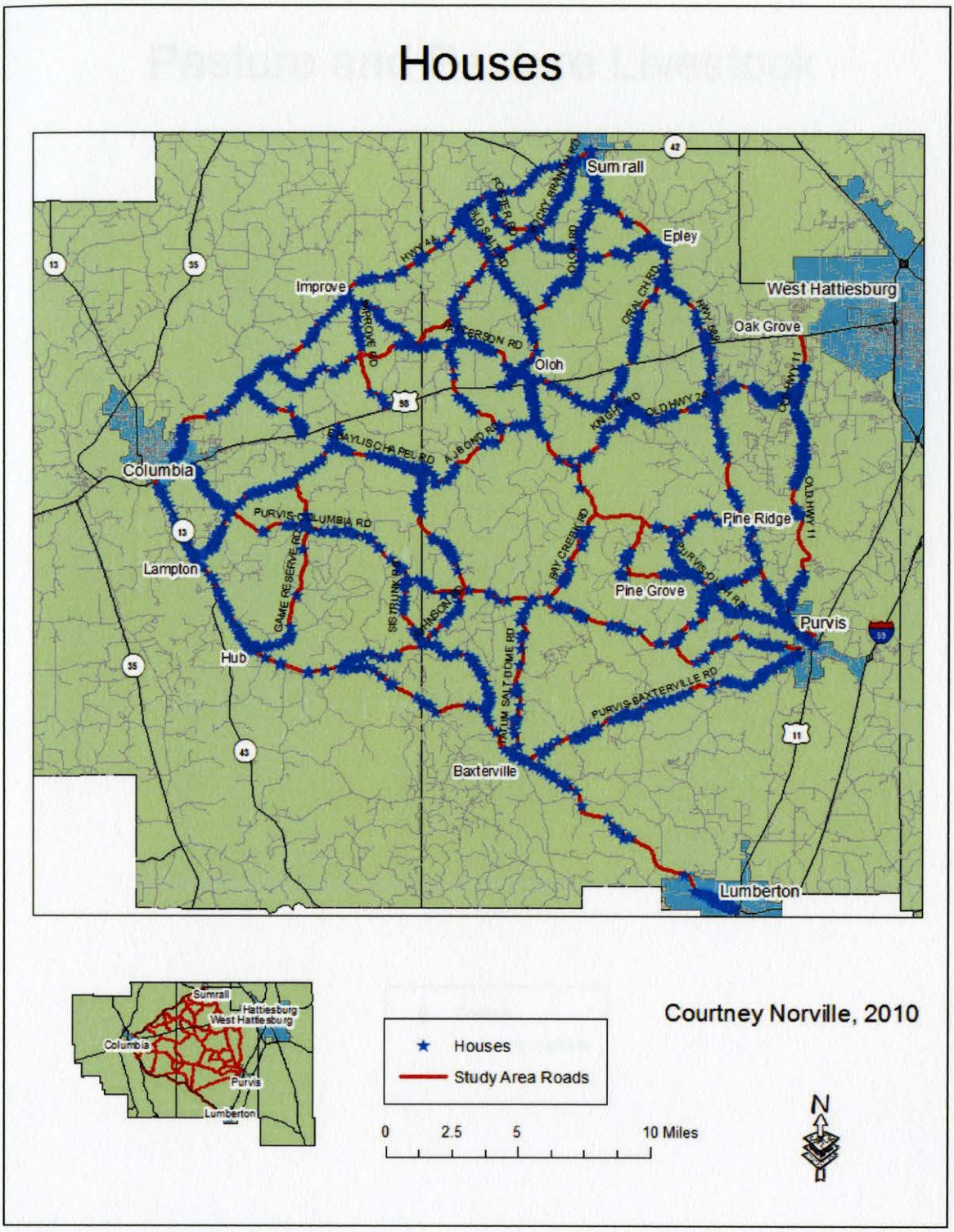

Figure 22. Map of Houses Based on Hand-Drawn Maps (Courtney Norville, 2010)

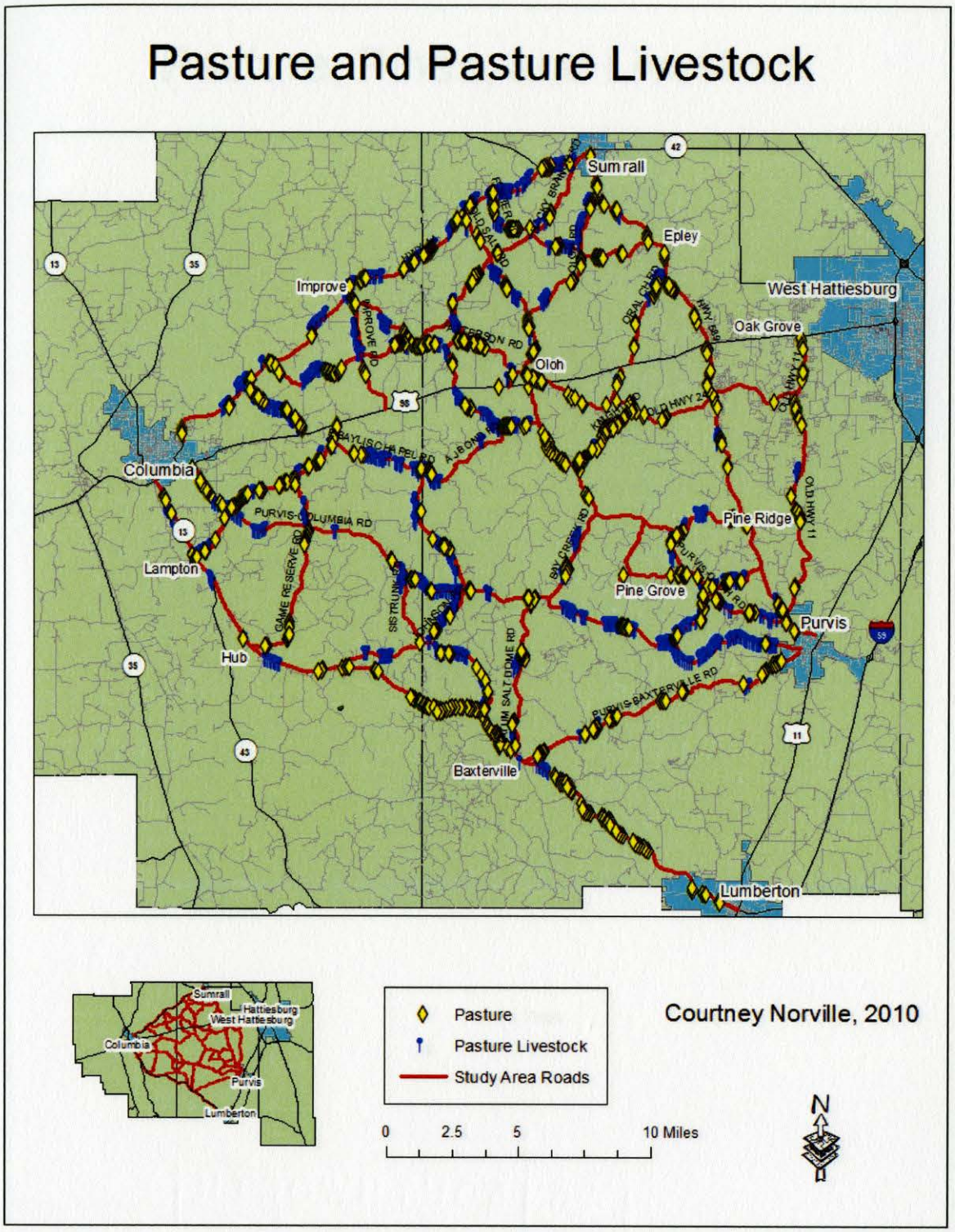

Figure 23 Map of Pasture and Livestock Based on Hand-Drawn Maps (Courtney Norville, 2010)

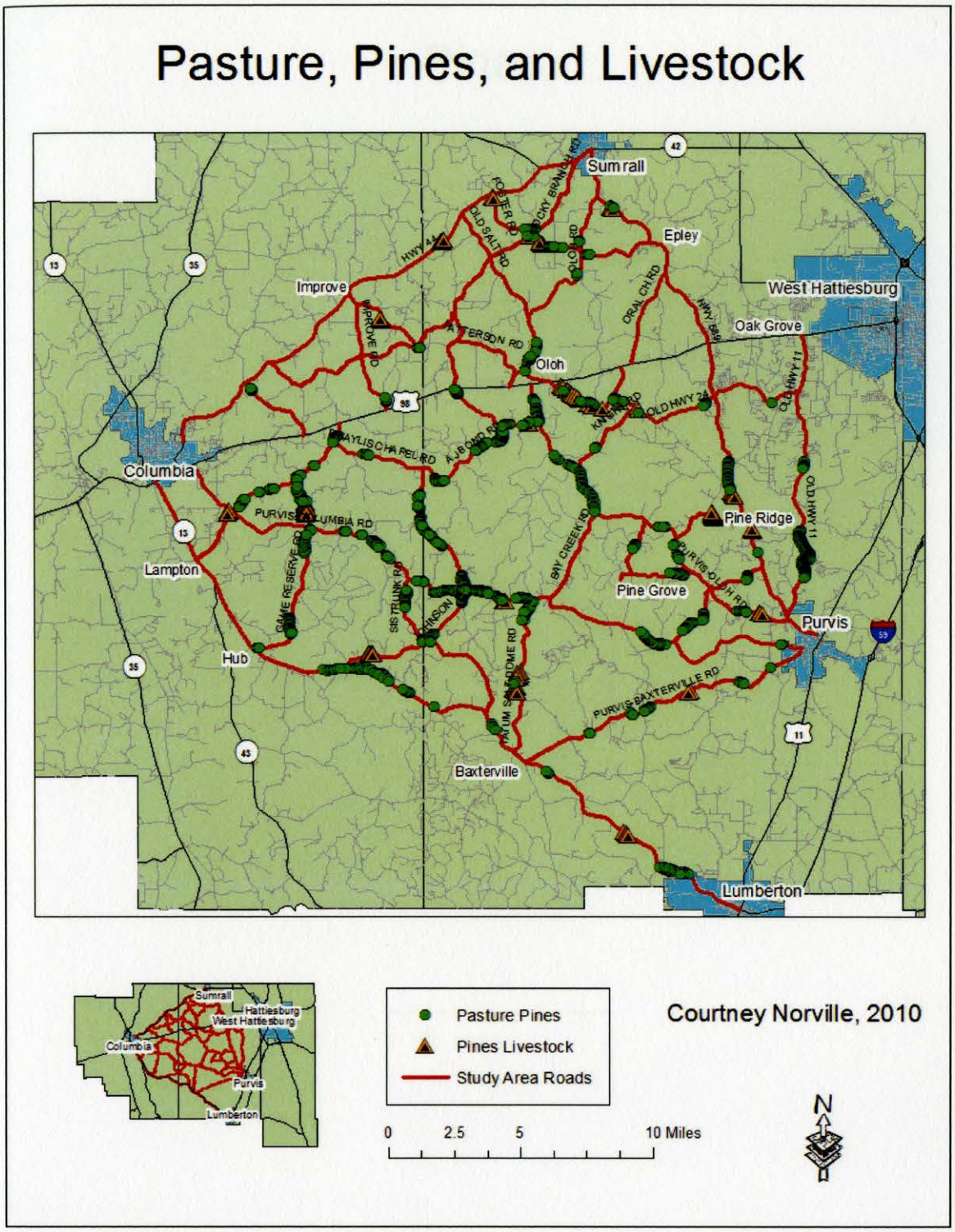

Figure 24. Map of Pasture, Pines, and Livestock Based on Hand-Drawn Maps (Courtney Norville, 2010)

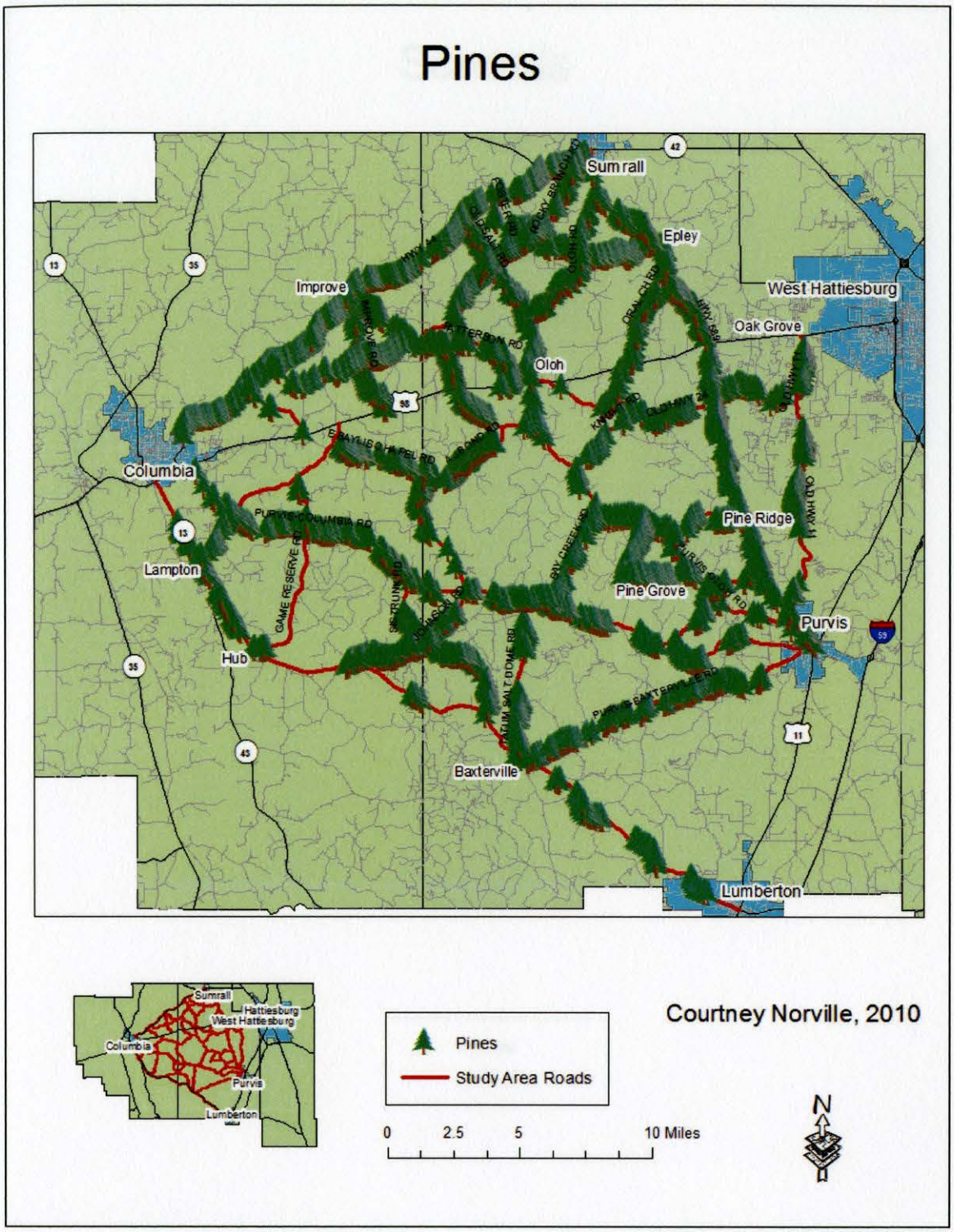

Figure 25. Map of Pines Based on Hand-Drawn Maps (Courtney Norville, 2010)

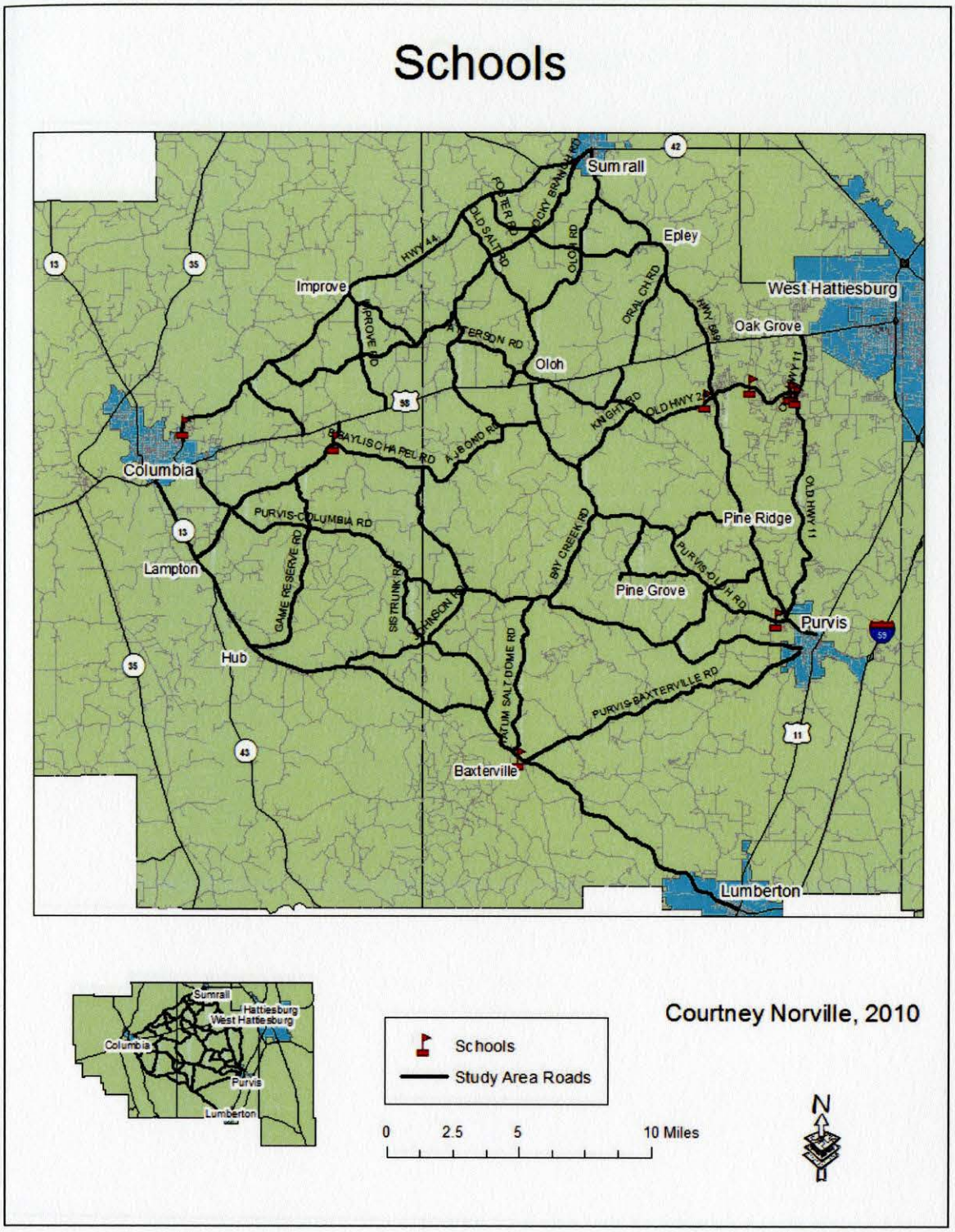

Figure 26. Map of Schools Based on Hand-Drawn Maps (Courtney Norville, 2010)

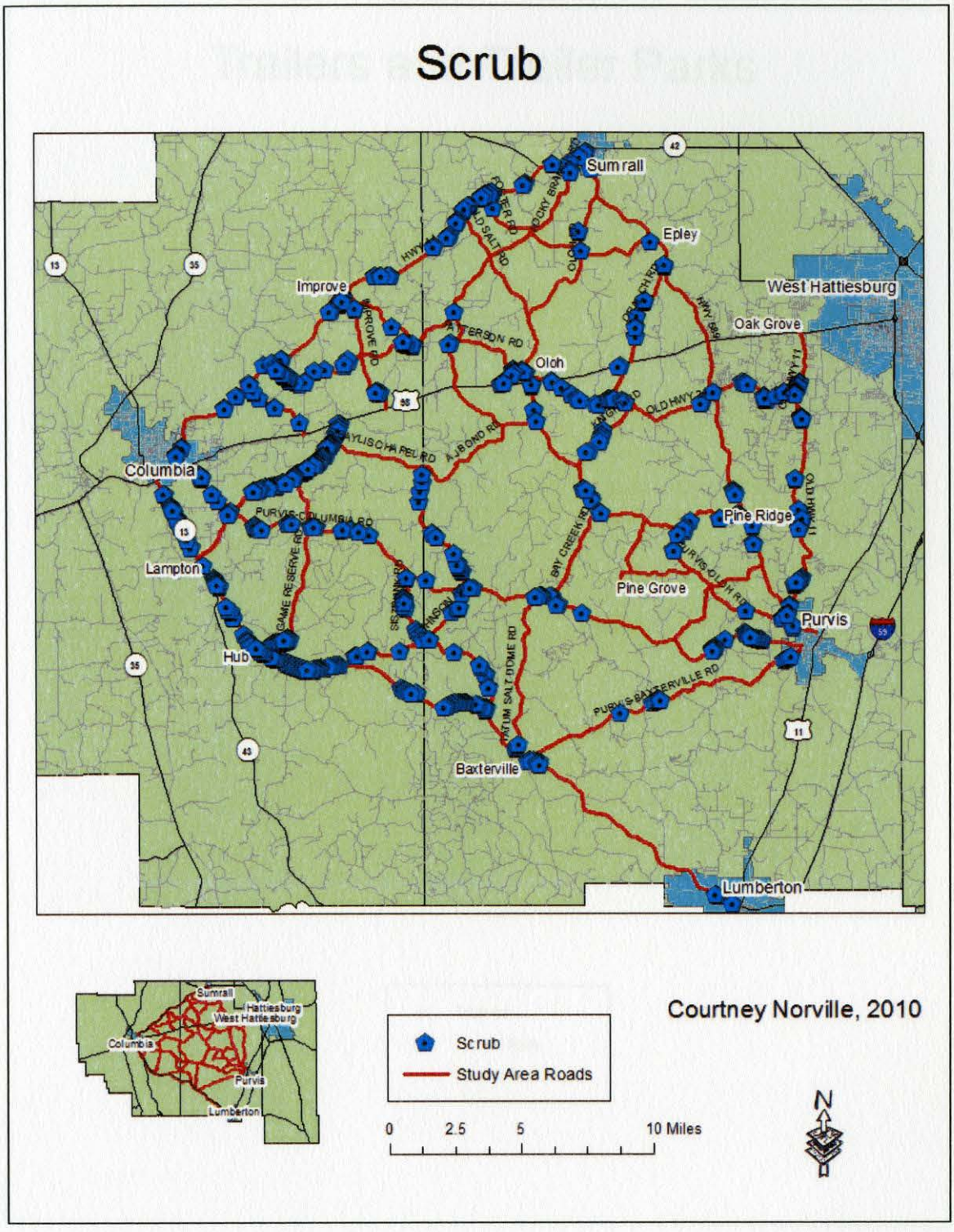

Figure 27 Map of Scrub Based on Hand-Drawn Maps (Courtney Norville, 2010)

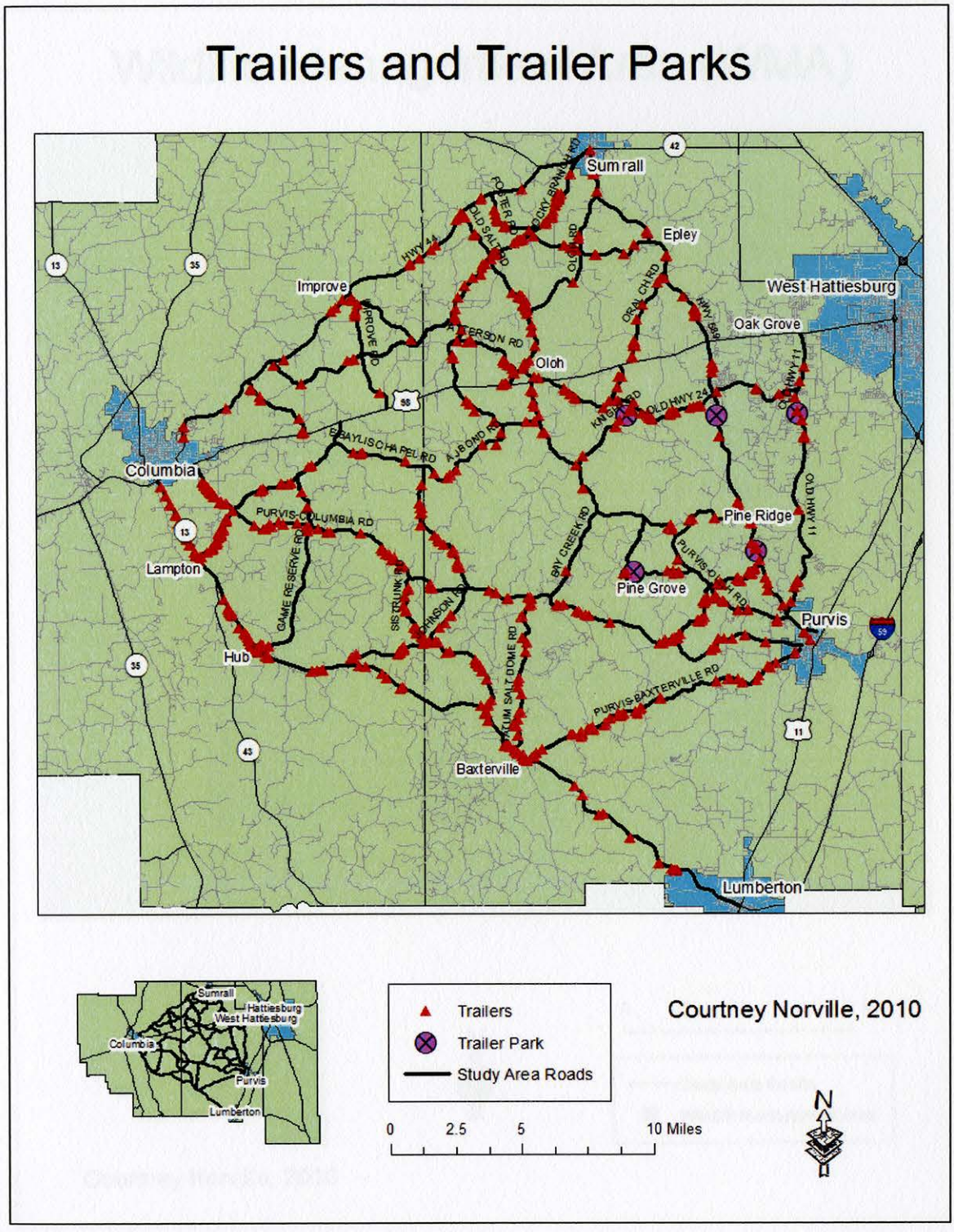

Figure 28. Map of Trailers and Trailer Parks Based on Hand-Drawn Maps (Courtney Norville, 2010)

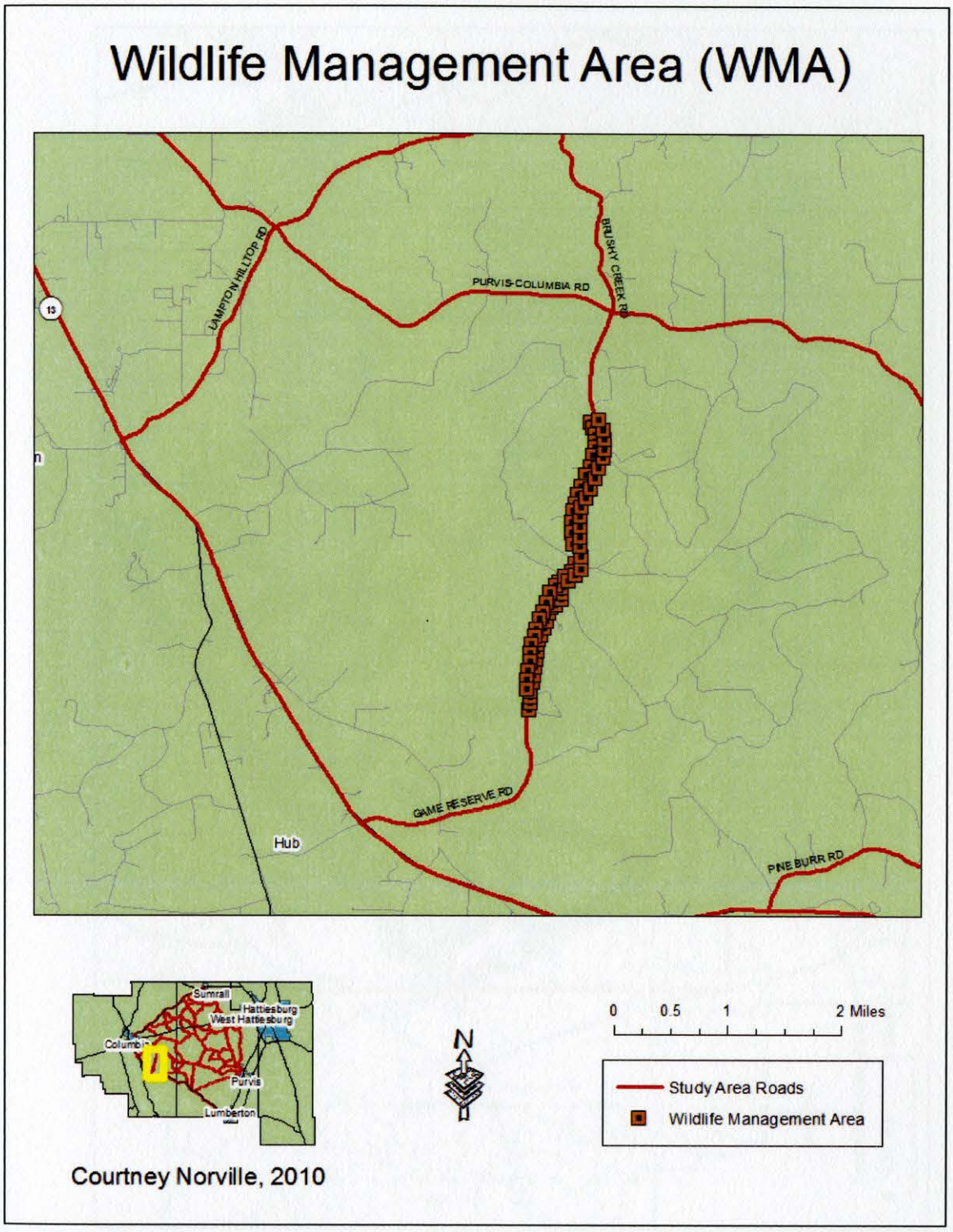

Figure 29 Map of Wildlife Management Areas (WMA) Based on Hand-Drawn Maps (Courtney Norville, 2010)

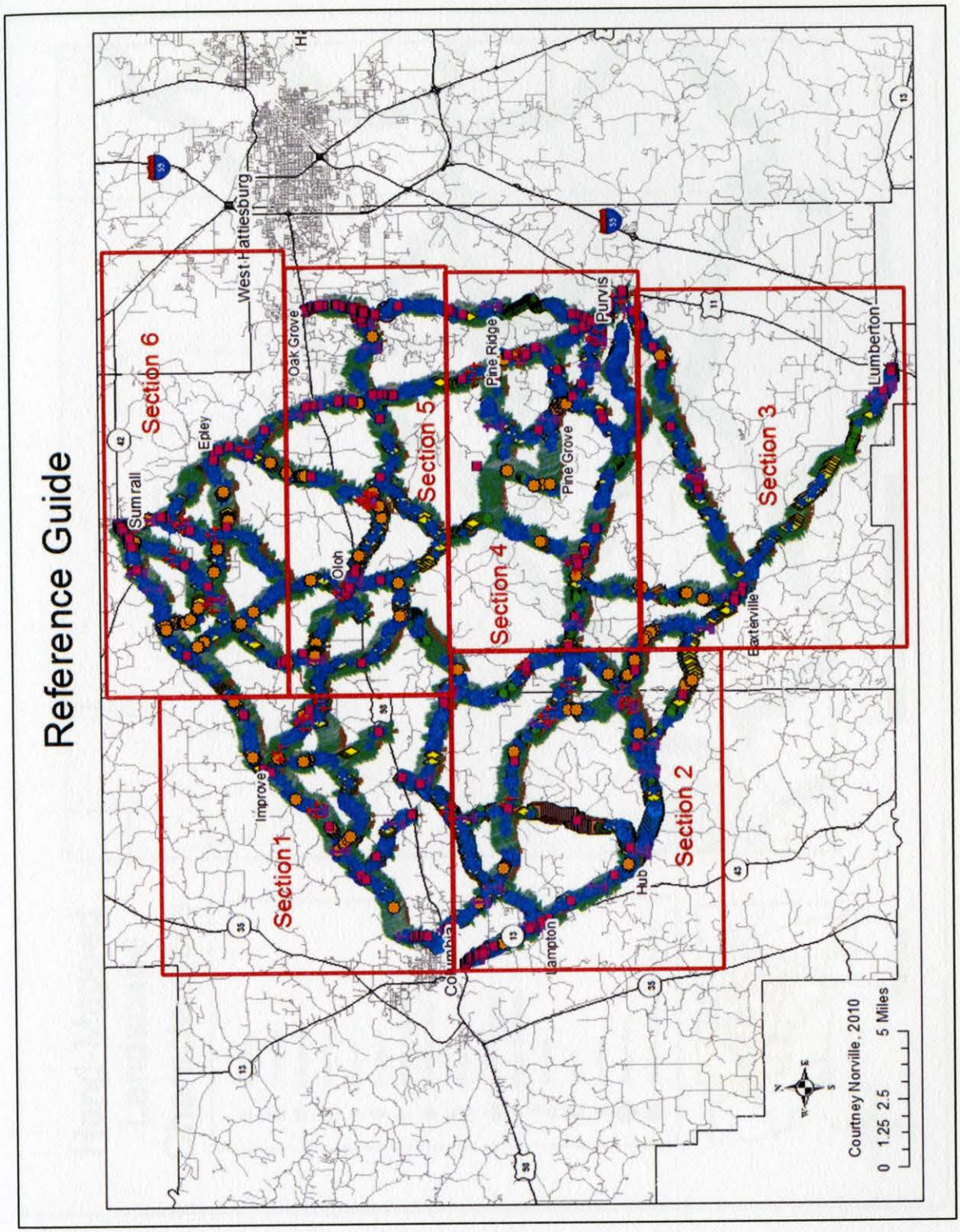

Figure 30. Reference Guide to Sections 1-6 of Hand-Drawn Maps (Courtney Norville, 2010)

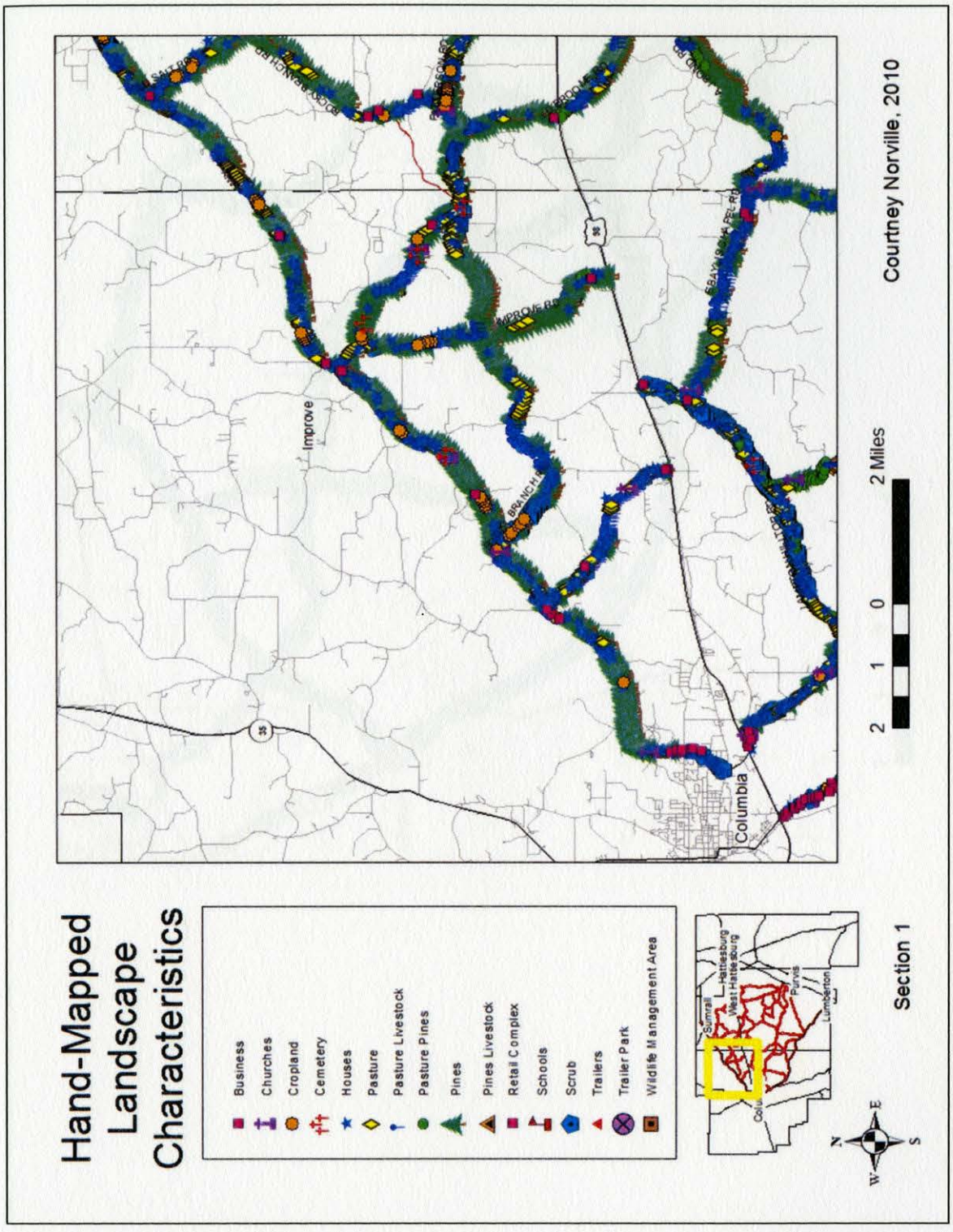

Figure 31 Section 1 Map of Landscape Characteristics Based on Hand-Drawn Maps (Courtney Norville, 2010)

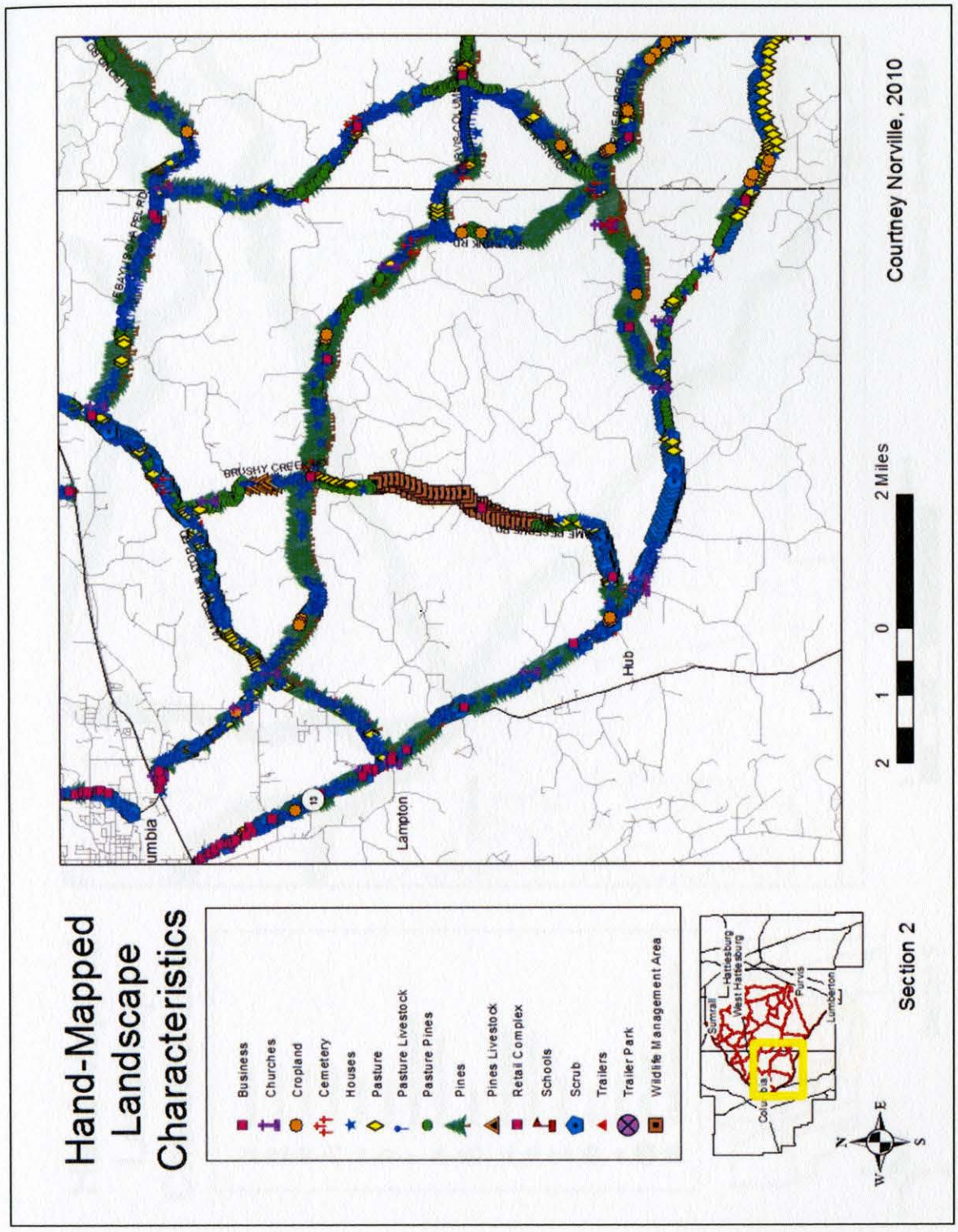

Figure 32 Section 2 Map of Landscape Characteristics Based on Hand-Drawn Maps (Courtney Norville, 2010)

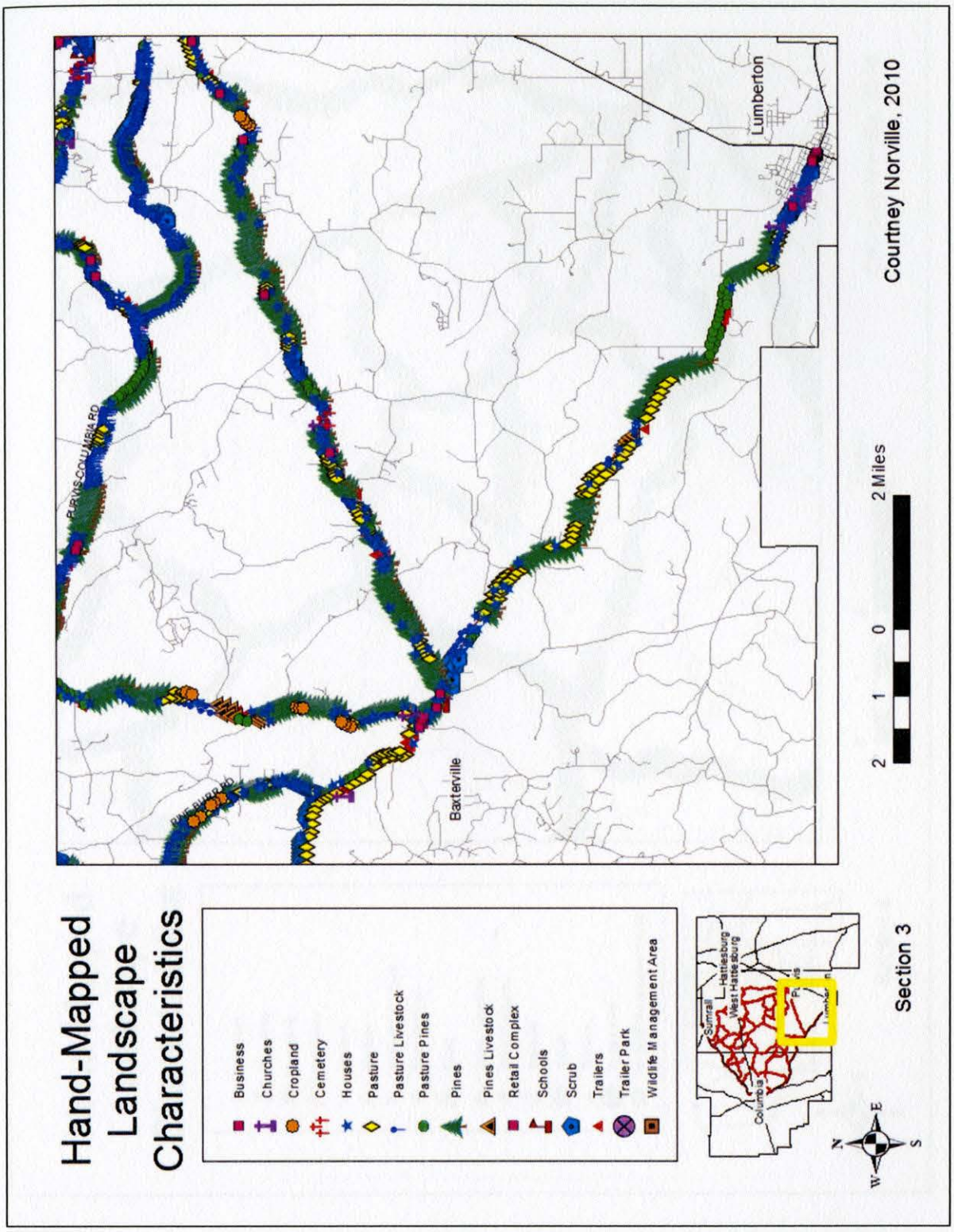

Figure 33 Section 3 Map of Landscape Characteristics Based on Hand-Drawn Maps (Courtney Norville, 2010)

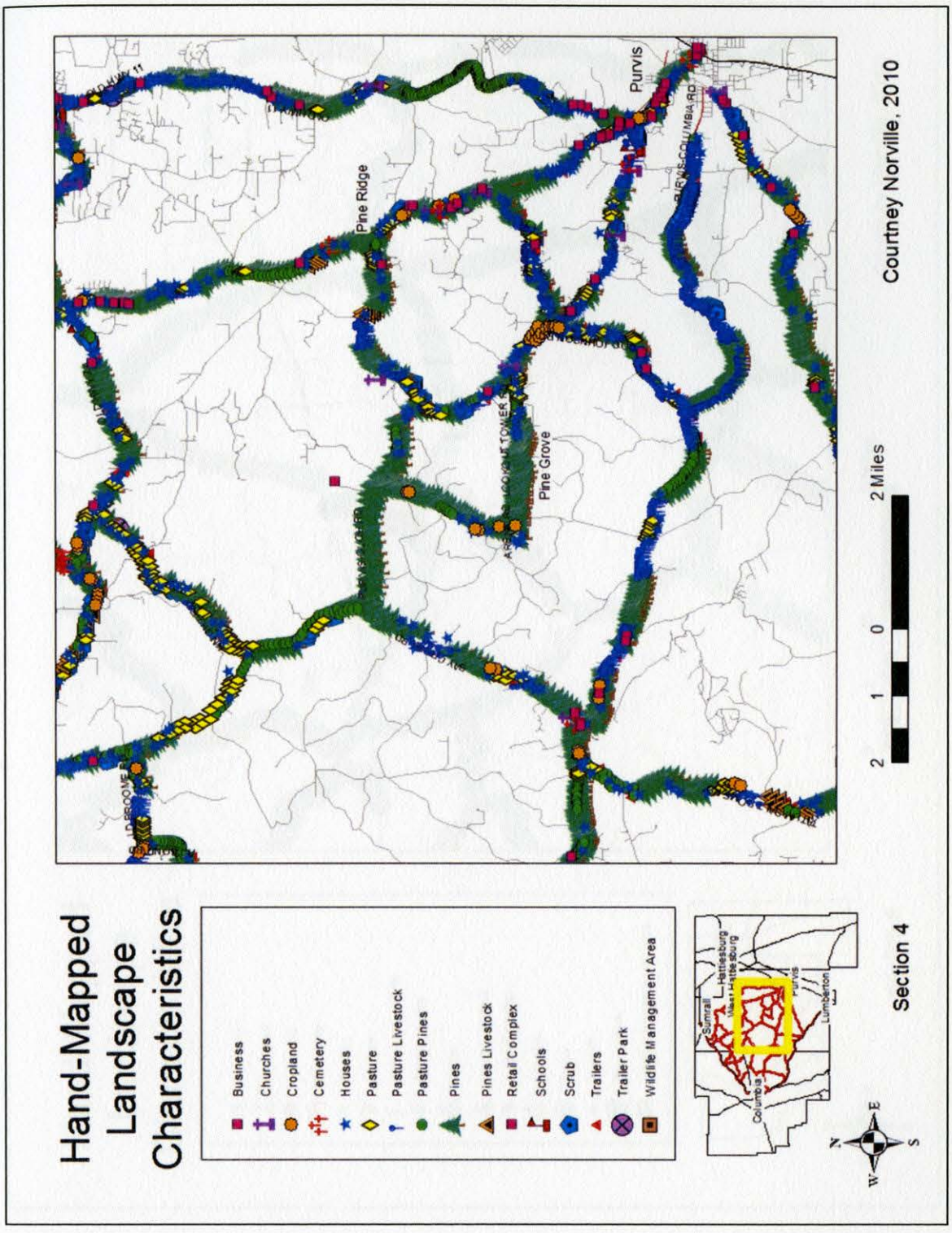

Figure 34. Section 4 Map of Landscape Characteristics Based on Hand-Drawn Maps (Courtney Norville, 2010)

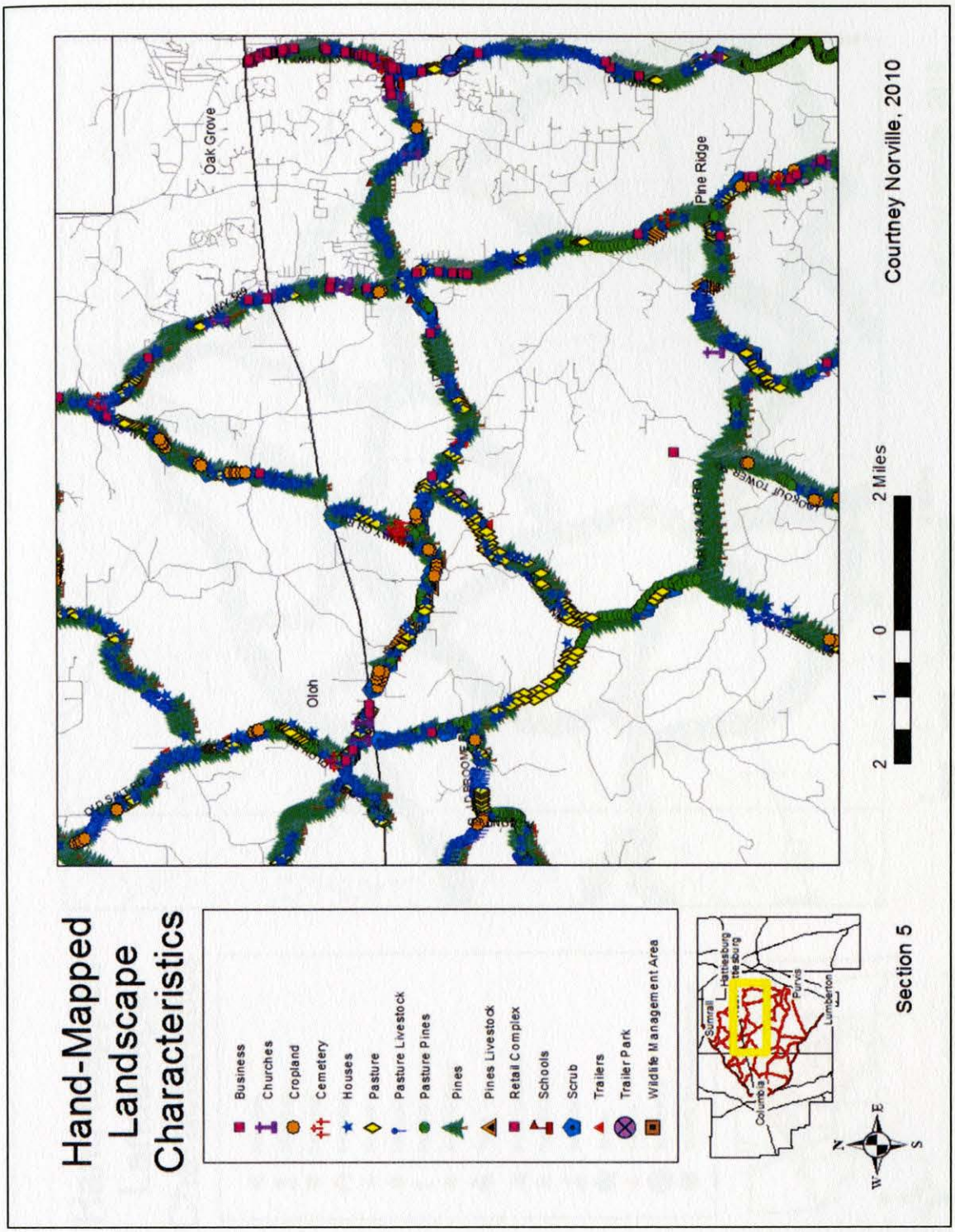

Figure 35 Section 5 Map of Landscape Characteristics Based on Hand-Drawn Maps (Courtney Norville, 2010)

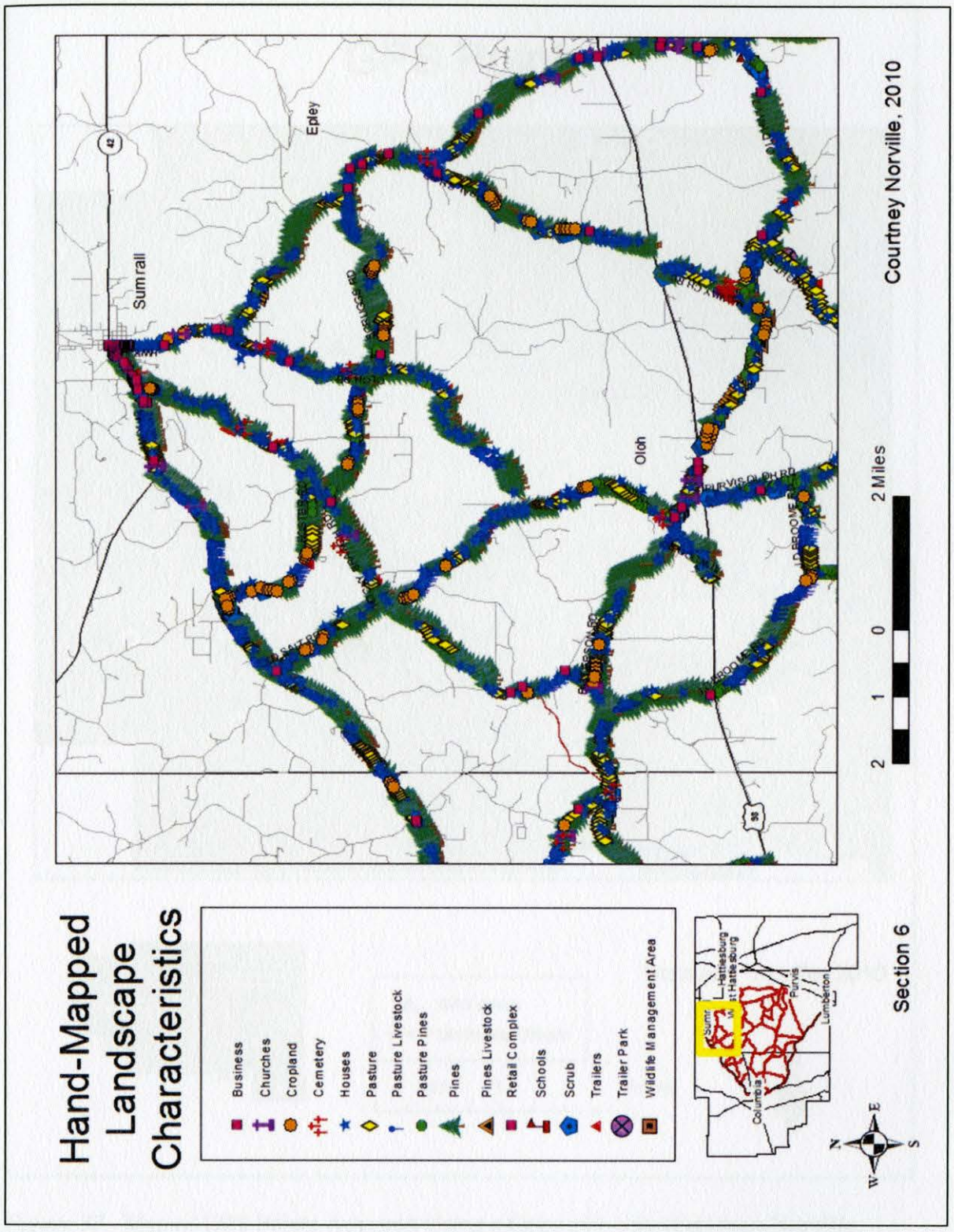

Figure 36. Section 6 Map of Landscape Characteristics Based on Hand-Drawn Maps (Courtney Norville, 2010)

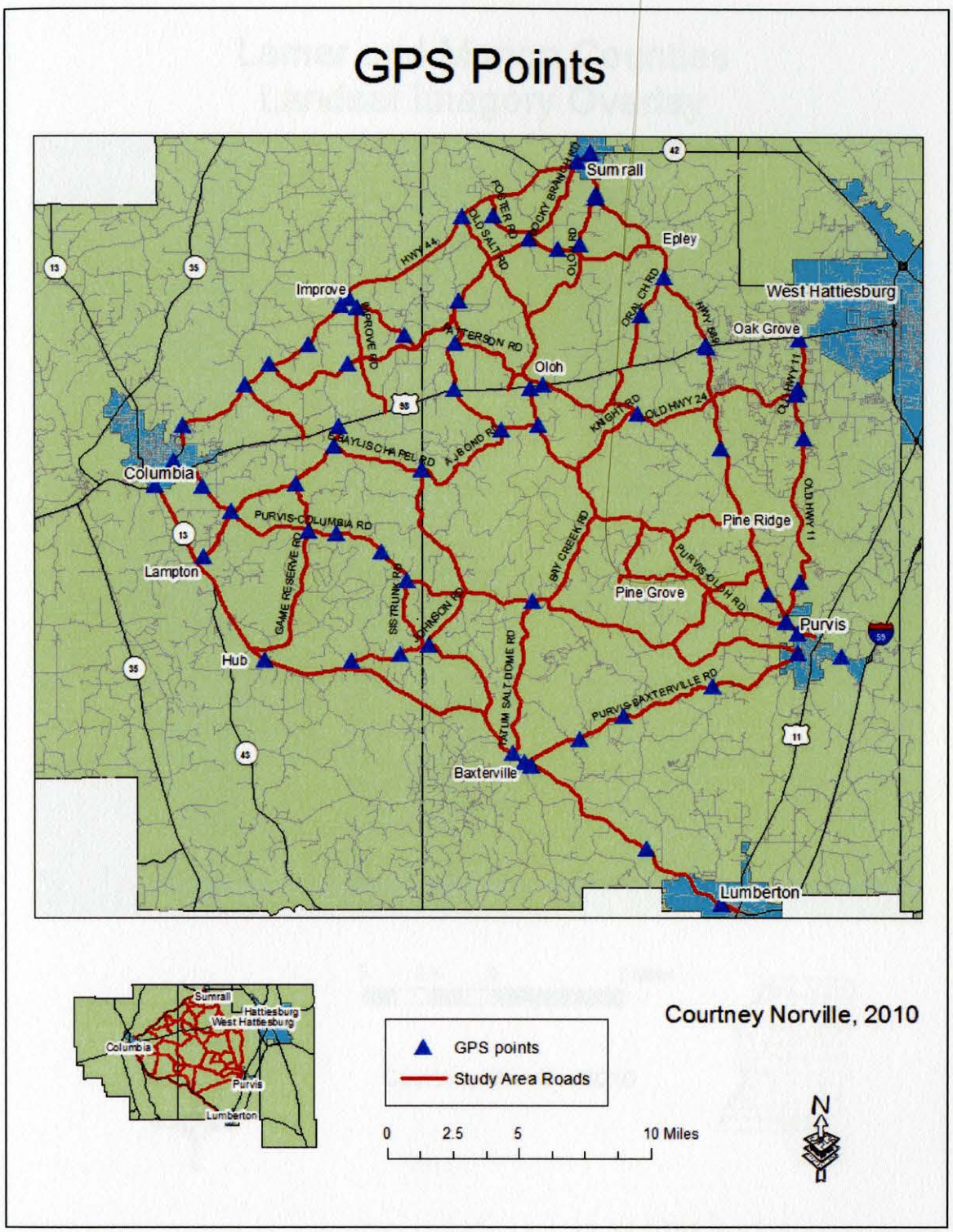

Figure 37 Map of GPS Points Acquired Using a Geko 101 Unit (Courtney Norville, 2010)

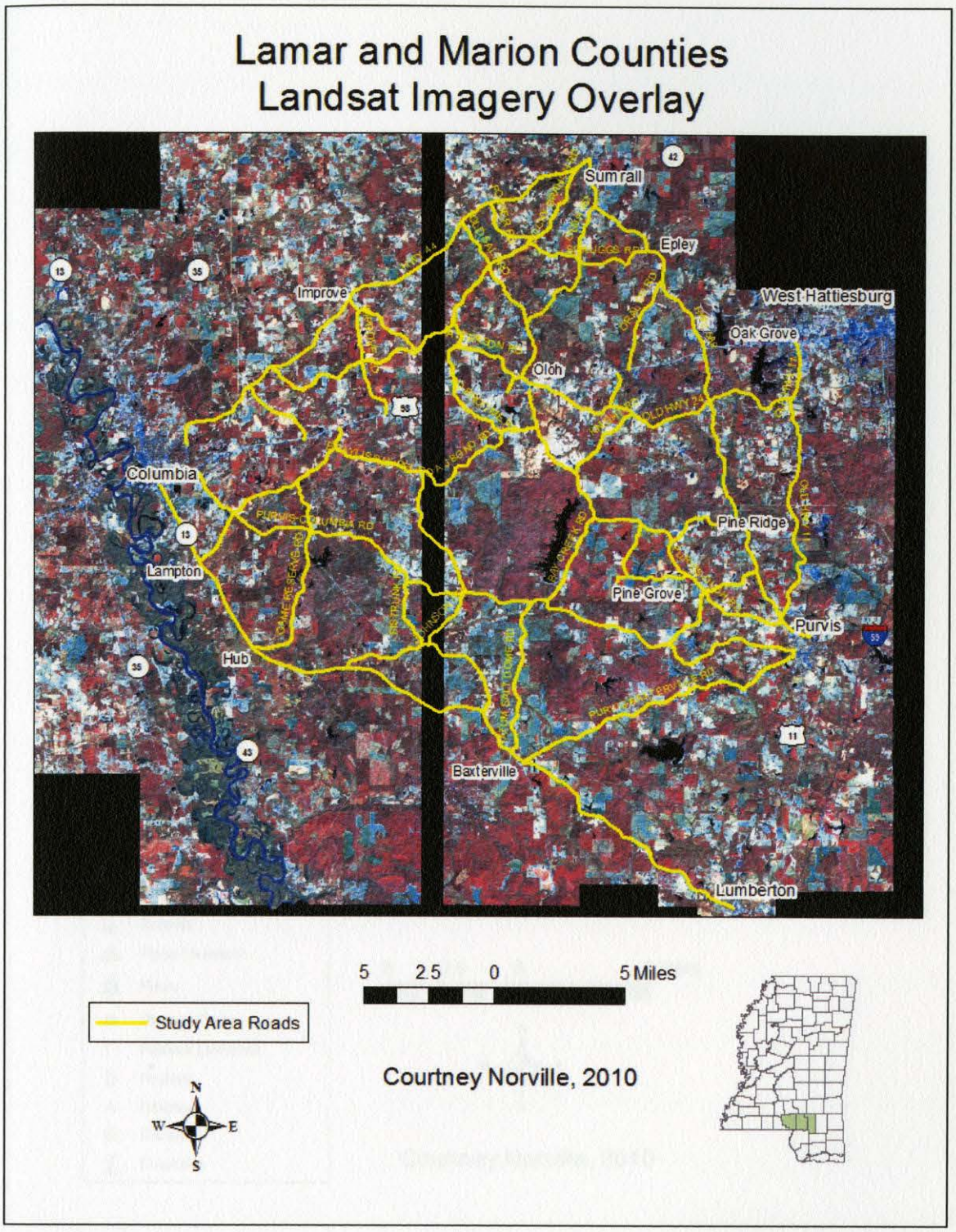

Figure 38. Map of Study Area Routes Overlain on Landsat Imagery (Courtney Norville, 2010).

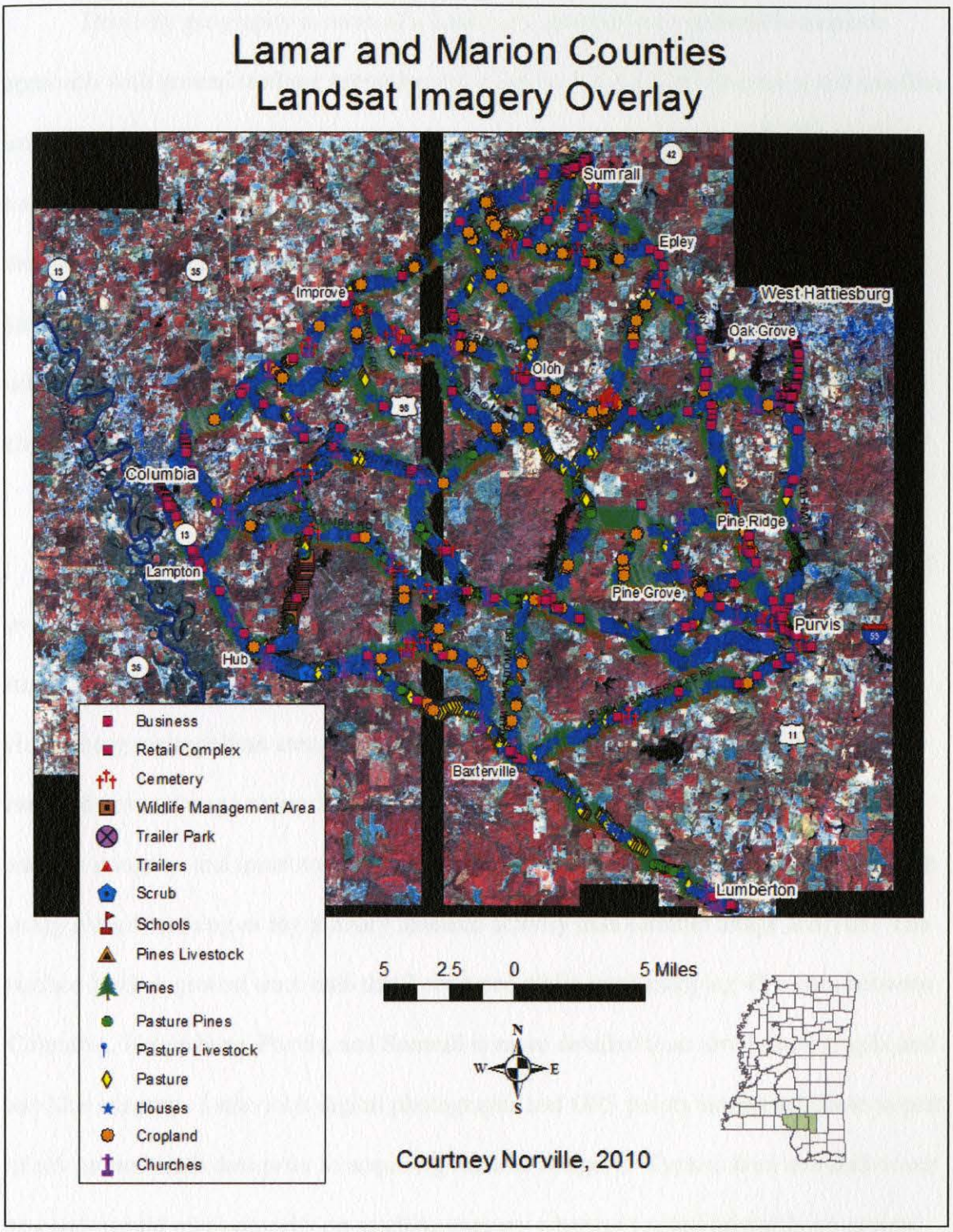

Figure 39 Map of Study Area Routes and Landscape Characteristics Overlain on Landsat Imagery (Courtney Norville, 2010)

Drive-by geography is more of a hands-on, qualitative or cultural/humanistic approach with ground truthing providing the basis for land-use interpretation and satellite imagery serving as the subsidiary activity This approach involves applying the data I collected from hand mapping to describe the land-use characteristics as they appear on the satellite image and in a narrative form in order to aid the reader in visualizing the landscape. I in turn used the data collected from hand-mapping each route to interpret urban growth instead of relying on satellite imagery like typical land use/land-cover change research.

Conclusion

This chapter has described the three data collecting/management activities I used in this thesis research. automobile-based transects, production of hand-drawn landscape maps, and digital conversion and overlay of those maps to analyze urban growth in the Hattiesburg metropolitan area. The methods I use are distinct from with typical land use/land-cover change research that relies primarily on the use of aerial photography, satellite imagery, and quantitative methods I have developed a more hands-on approach using ground truthing as my primary research activity than satellite image analysis. The surface level or ground truth data that I collected while hand mapping 45 routes between Columbia, Hattiesburg, Purvis, and Sumrall is more detailed than aerial photographs and satellite imagery I also took digital photographs and GPS points along each route as part of my ground truth data prior to acquiring satellite imagery Typical land use/land-cover research would rely primarily on satellite imagery whereas I relied primarily on ground truth data such as the hand maps, digital photographs, and the GPS points.

Next, I took the hand-drawn maps for each route and digitized the data into ArcGIS 9 software to create a digital map. In order to produce the digital map, I generated a shapefile for each land-use type based on the 17 land-use categories I defined to be used for analysis. I combined the data for the pine plantation and scrub land-use categories into a single shapefile called pines. The GPS points acquired in the field were also inserted into a shapefile to be used for verification of the physical structures. Lastly, Landsat 2002-2003 imagery of Forrest, Lamar, and Marion counties was acquired from MARIS to be used for this thesis. I then overlaid each shapefile onto the Landsat imagery to determine the value of this qualitative approach in the analysis of urban growth patterns.

CHAPTER III

ANALYSIS

I used the data collected during field research to write a series of travel narratives describing several transects and to analyze all the transects using a buffer model and point density analysis in ArcGIS 9.3 My narratives document my experiences and my perceptions of the landscape along the transects whereas the spatial analytical activities use data generated from my hand maps. The first section of this chapter contains descriptions of two routes that illustrate how land-use characteristics can be communicated in narrative form. The second section contains an application of the Burgess model using a multiple ring buffer to examine land use in the study area. The third section describes a point density analysis that I conducted to characterize the study area as either urban, suburban, exurban, or rural. I used the results of this analysis to compare urban and exurban growth between the routes north and south of Highway 98

Narratives

I wrote narratives for two routes relying upon digital photographs and hand-maps, as well as the field notes I wrote during research. Narratives are a form of storytelling that is done to explain an experience. "The main claim for the use of narrative in educational research is that humans are storytelling organisms who, individually and socially, lead storied lives" (Connelly & Clandinin, 1990, p. 2) The narratives provide insight into how I perceived human interactions with the landscape based on my direct observations, as well as my memories. The narratives relate to Lewis's quote in Chapter I describing the importance of landscape and place and the need for us to understand their meanings rather than judging them at first glance.

> Give no preference to rural or to urban landscapes, modern or old, elite or ordinary, designed or undesigned. Human landscape is a document wherein cultures unwittingly reveal their present and their past in a kaleidoscopic array of things, patterns, and symbols Before rushing to judge a landscape ugly or beautiful, pause and try to understand how it came to be, and what it says about the people who created it. There is intellectual stimulation everywhere for one who keeps eyes and mind open. There is beauty too. (Lewis, 1983, p. 248)

I chose Old Highway 24 South, which is south of Highway 98, and Pierce Road, which is north of Highway 98, to provide an example of a narrative for both north and south sections of my study area.

Old Highway 24 South (A Personal Narrative)

Old Highway 24 South is a great example of how the area west of Hattiesburg forms a transition from urban and suburban to exurban and rural landscapes This route runs from Old Highway 11 in Oak Grove to Highway 98 near the community of Oloh. The westernmost section of Old Highway 24 South still resembles a small, two-lane, surfaced country road. From Highway 98 it is lined with pastures and croplands under various land-use regimes, grazing livestock, and a mixture of old and new homes, all interspersed within a piney woods forest landscape of longleaf pines (*Pinus palustris*), post oaks (*Quercus stellata*), loblolly pines (*Pinus taeda*), and sweet gums (*Liquidamber styraciflua*) At the intersection of Warden Road, a blueberry farm is located on the left (north) side of the road. Continuing east on Old Highway 24 South, through patches of scrub woodland, forest, pastures with grazing cattle, and a thin distribution of houses, the traveler will eventually reach Oak Ridge Lane. The area between Oak Ridge Lane and

Ratcliff Road is dominated by a private trailer park and a cluster of homes and that are so close together they are almost certainly occupied by an extended family This area occupied with all of the trailers feels more congested, with much less open space available compared to areas of farmland along this route. The landscapes along Old Highway 24 range from patches of pine trees and scrub woodlands between Ratcliff Road and WPA Road to a sudden transition from rural to exurban and finally to suburban as you approach the subdivisions of Oak Grove. Even here, there are vestiges of rural landscapes in the form of actively maintained livestock pastures and isolated stands of pines scattered alongside increasing numbers of suburban homes. Right before reaching Oak Grove Upper Elementary School, there is a dense area of older homes and trailers, possibly the remnants of an old center of settlement. Beyond Oak Grove Upper Elementary School, larger and newer homes are distributed fairly close to one another up to Highway 589 South. The stretch after Highway 589 South ends at Old Highway 11 South. Coming closer to Oak Grove, the landscape is dominated by several subdivisions with larger, more rural properties in between. About a mile before the end of this route, homes, businesses, and schools sit almost on top of each other. The end of Old Highway 24 South resembles a small urban or suburban area with a gas station, church, cemetery, snow cone place, and various shops.

Pierce Road (A Personal Narrative)

Pierce Road runs from Highway 98 to the outskirts of Columbia at Highway 44, and crosses a landscape transition as does Old Highway 24 South. The intersection of Highway 98 and Pierce Road is approximately ten miles from downtown Columbia. Turning onto Pierce Road, off Highway 98, the traveler goes up a slight hill to find an

industrial property on the north side of the street across from a scattering of a few brick homes and a trailer The roadside past the industrial property is covered with an encroaching patch of kudzu. Moving further down the road, there is a mix of home styles near each other on a large piece of property Some of the homes are so close to each other they seem to make up a little family compound or exurban center Utilities are above ground along this route and most houses have propane tanks. Further along, there is a ranch-style home with a water tower almost directly across from a very interesting house that resembles a little compound. The little compound is surrounded by a white picket fence. It has several building such as a shed, garage, the large living quarters, and a smaller living quarters that are all interconnected. It looks as if the smaller living quarters could be like a grandmothers house that people build on their properties to keep family close to watch over them. Past this compound is couple of smaller ranch style homes and then a larger new looking brick house with a large gym set across the street from a small older brick home. The traveler then come upon several trailers followed by First Graves Creek Baptist Church and its cemetery Along this stretch of the road, there are pastures on both sides, fenced in with barbed wire and metal cans on top of almost every post. The pasture on the south side of the street is more open with some grazing cattle whereas the north side is more wooded with regular cattle, longhorns, and lots of pecan trees (*Carya illinoinensis*) An old barn houses tractors and plows near the fence of the northern pasture as well. A homemade rodeo pen with lights in the middle of the southern pasture. As you continue along with pasture on both sides you come to a new black asphalt driveway on the north side that winds way back in the pasture to a huge ranch home, barn, and stables. The view then continues to be pasture and livestock for a

bit with the road edge on the north side more tree lined. The pasture area ends on the south side first where you find a ranch style home with a chain length fence and what looks to be an old homemade softball field in the back yard. Past the chain length fence pines are planted in rows next to another ranch style home. Then an ornamental white picket fence lines the side of a property not attached to anything. It just lies between pines planted in rows as if it could be a property marker You then come to a trailer past the pines followed by a tin roof brick home with a hay pasture behind the home and beyond the home going toward Highway 44. The pasture on the north side of the road continues until you reach a wooden house next to a run-down trailer on the south side of the road. There is an interesting small patch of cane in the pasture on the north side right before the pasture stops at the old run down homes along with a patch of cane in front of one of the homes. You again come up to a couple of ranch style homes on both sides of the street followed by trees, brush, and Pomegranates (*Punica granatum*) The north side then turns into a pine farm followed by a brick home on lots of acreage. There is a sporadic ranch style home along the south side past the brush that is followed by a junky trailer Just past this trailer is another small ranch style home with a huge house offset behind the pasture. There looks to be a small new home being built in the pasture in front of the huge offset home just before the end of Pierce Road. Across from the new home is an older home that looks uninhabited at the corner of Pierce and Highway 44. Traveling on Pierce Road from Highway 98 resembles an exurban area that leads into rural land and then back into exurban area before coming to an end. This route has several transitions in the landscape as well as evident changes in socioeconomic class. This is a route that you

would never know had such a beautiful landscape based on the views of where it begins and ends

Multiple Ring Buffer

I used data from the transects and my hand-drawn maps to identify and describe features of the landscape as observed from an automobile. These data are derived from hand mapping and GPS points I acquired in the field, whereas the narratives consist more of my general observations about the landscape. My analysis of urban growth is based on the Burgess model, which uses rings or concentric zones moving away from an urban center to visualize urban growth and morphology, and is intended to show a relationship between socio-economic status of households and distance from Central Business Districts (Hartshorn, 1980) I used the buffer tool in ArcGIS to produce Burgess rings as a way to understand where urbanization and exurban growth is transforming the landscapes around Hattiesburg (Bolstad, 2002).

I first constructed a six-ring buffer around Hattiesburg, with each ring five miles wide, that expanded outward until it reached Columbia (See Figure 40) I created a point shapefile marking the route closest to Hattiesburg that I collected data from as the center of the multiple ring buffer Next, I tallied the points for each land-use category in each ring to determine the proportion of its area within (See Table 3) Finally, I compared the percentages of each land-use category between the six buffer sections to characterize urban growth west of Hattiesburg.

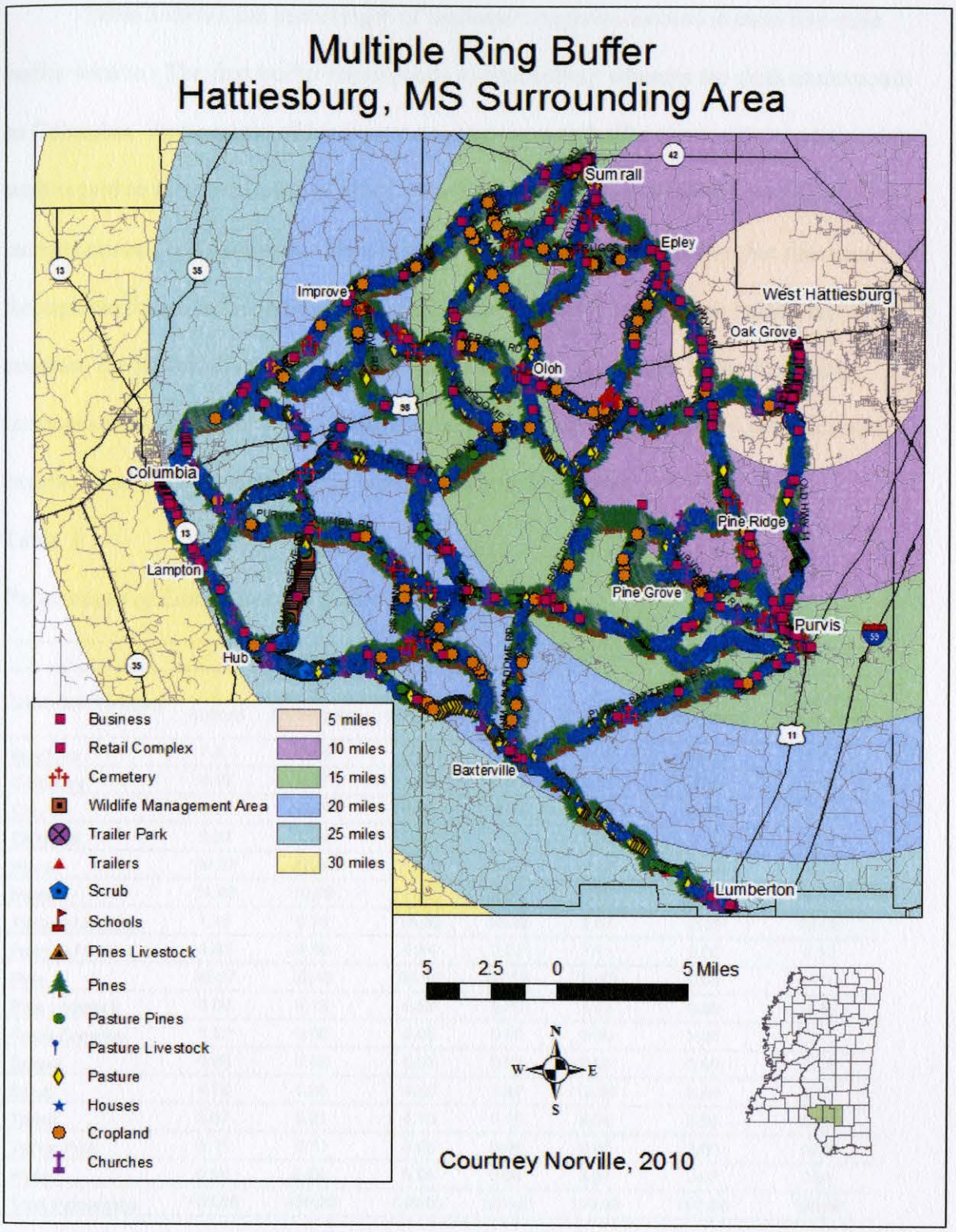

Figure 40. Multiple Ring Buffer (Courtney Norville, 2010)

Table 3 shows the percentages of land-use categories located in each five-mile buffer section. The first buffer corresponds to Hattiesburg whereas the sixth corresponds to Columbia. Percentages of land-use categories in each buffer show a close relationship with regard to their proximity to cities The house and pasture-livestock land-use categories are good examples. Houses make up 29 % of the first buffer, but decrease through the fourth buffer before increasing again with 41% in the sixth buffer By contrast, the pasture-livestock category makes up only one percent in the first buffer, increases through the second and third buffers, which are predominantly suburban and exurban, and then decreases again moving towards Columbia.

Table 3

Percentages of Land-Uses per Buffer Section

	Percentages of Land-Uses Per Buffer Section						
Land-Use Category	1 (Urban)	2 (Suburban)	3 (Exurban)	4 (Rural)	5 (Exurban)	6 (Suburban)	Total Area Percentage
Business	7.21	1.46	2.89	0.88	2.63	35.29	2.45
Cemetery	0.13	0.47	0.22	0.33	0.05	0.00	0.25
Church	1 18	0.47	0.30	0.39	0.88	2.95	0.52
Cropland	0.52	2.44	2.35	1.51	1.03	0.00	1 79
House	28.57	20.84	16.76	13.83	21.54	41 18	18.34
Pasture	11.93	10.76	9.61	8.39	9.17	5.88	9.55
Pasture Livestock	1 18	8.78	15.33	14.98	9.07	0.00	12.08
Pasture Pines	1.83	9.30	6.94	7.57	7 11	0.00	7 17
Pine	36.57	32.43	34.52	37.53	23.13	0.00	33.07
Pine Livestock	0.00	2.18	0.59	0.75	1 13	0.00	0.95
Retail Complex	1.57	0.00	0.00	0.00	0.00	0.00	0.11
School	0.66	0.00	0.03	0.07	0.05	0.00	0.08
Scrub	4.72	5.25	4.26	7.67	12.36	5.88	6.75
Trailer	3.67	5.51	6.15	6.10	8.24	8.82	6.23
Trailer Park	0.26	0.11	0.05	0.00	0.00	0.00	0.05
WMA	0.00	0.00	0.00	0.00	3.61	0.00	0.61
Total Percentage	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Note: Section 6 had only one mile of observation which explains the multiple land-use categories with a zero percentage for this section.

I created pie charts to visualize the percentages of land-use categories among the six buffers (Figures 41 to 46). Each chart shows the six most prominent land-use categories of each buffer section. The charts for the pine, business, and pasture-livestock categories prove to be the most interesting. The pine landscape category has the highest percentage of area in all buffers, illustrating the dominance of pines in South Mississippi regardless of urban or rural setting. The business category came in fourth highest in Buffer One, which is in Hattiesburg, and second highest in Buffer Six, which is in Columbia. I expected the business category would have been the highest in Buffer One instead of fourth highest. The business category came in fourth highest due to the prevalence of housing for the population of Hattiesburg and Oak Grove. The pasture-livestock category held fifth highest in Buffers Two and Five, third in Buffer Three, and second in Buffer Four, which is a predominantly rural area.

I also placed a multiple ring buffer around Columbia, Hattiesburg, Sumrall, and Purvis to ascertain the resulting pattern of overlapping buffers (Figure 47) The Hattiesburg and Sumrall buffers have rings that correspond to distances of 5 and 10 miles from the center point. The Columbia and Purvis buffers have rings representing 5, 10, and 15 miles where they overlap with the other multiple ring buffers. I created a shapefile called 'Exurban Areas' to include areas that overlapped which mark exurban landscapes that lie on the periphery of communities. Based on my analysis, there are five areas most likely to contain exurban landscapes. One area lies approximately 10 miles from Sumrall and Hattiesburg. A second area lies approximately 10 miles from Hattiesburg and Purvis. A third area lies approximately 10 miles from Sumrall and fifteen miles from Purvis The fourth exurban area lies approximately ten miles from

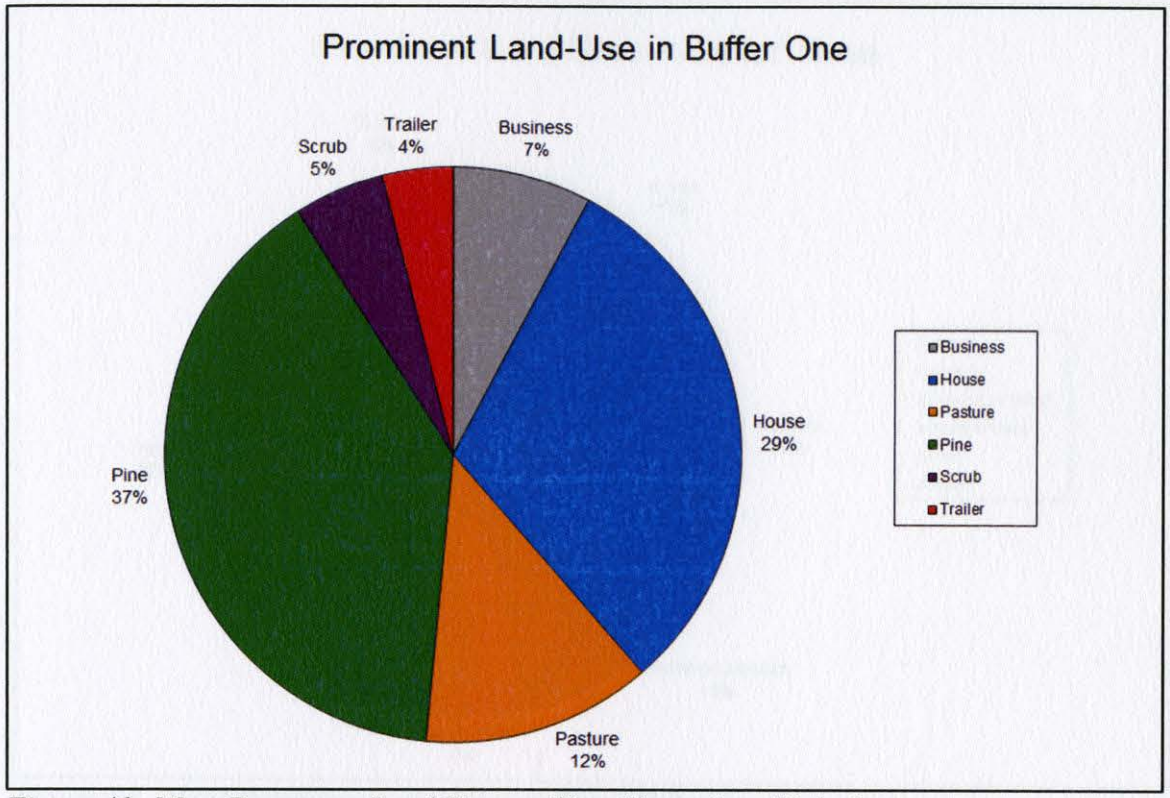

Figure 41 Most Prominent Land Uses in West Hattiesburg/Oak Grove.

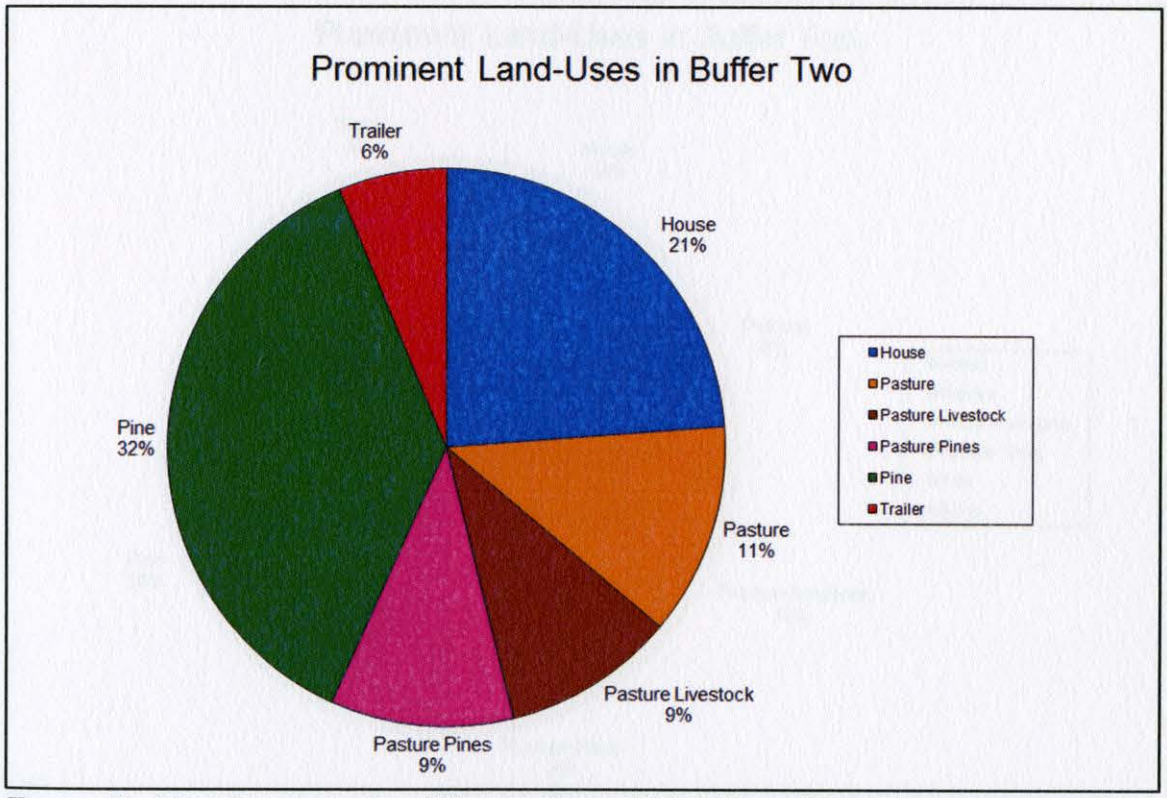

Figure 42 Most Prominent Land Uses in Sumrall/Oak Grove/Purvis.

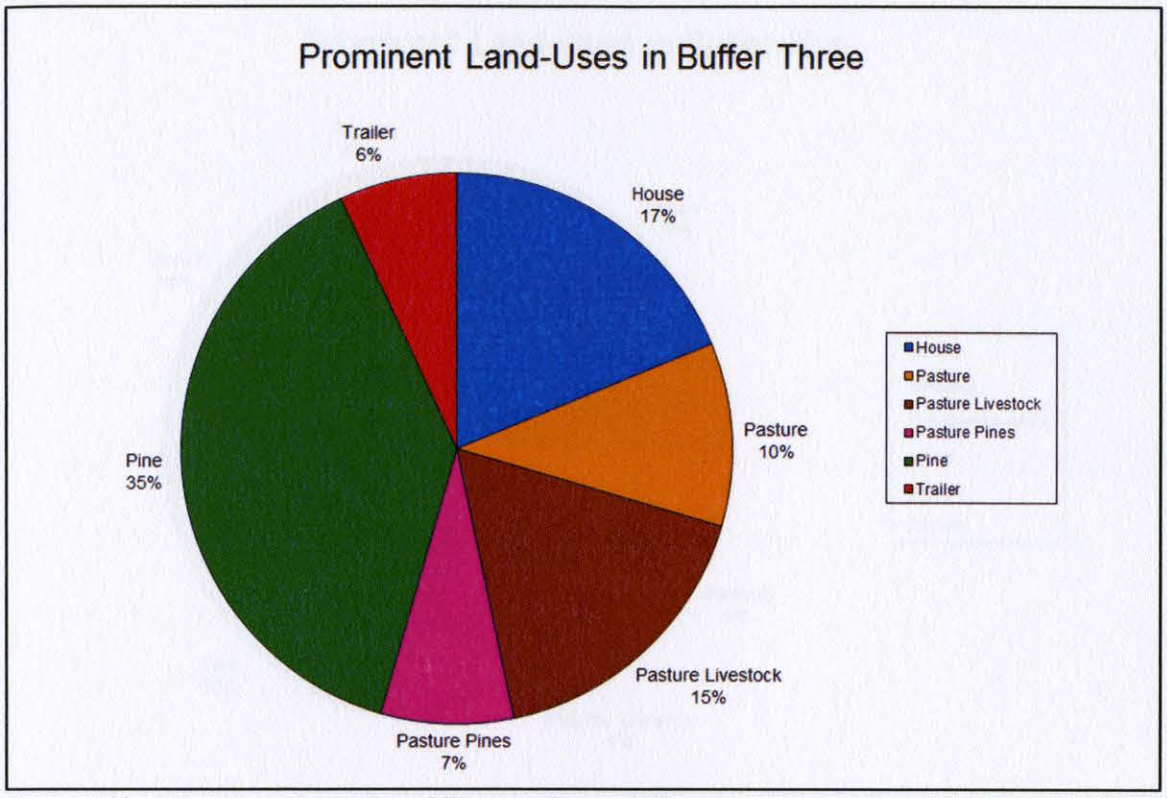

Figure 43 Most Prominent Land Uses in Sumrall/Purvis.

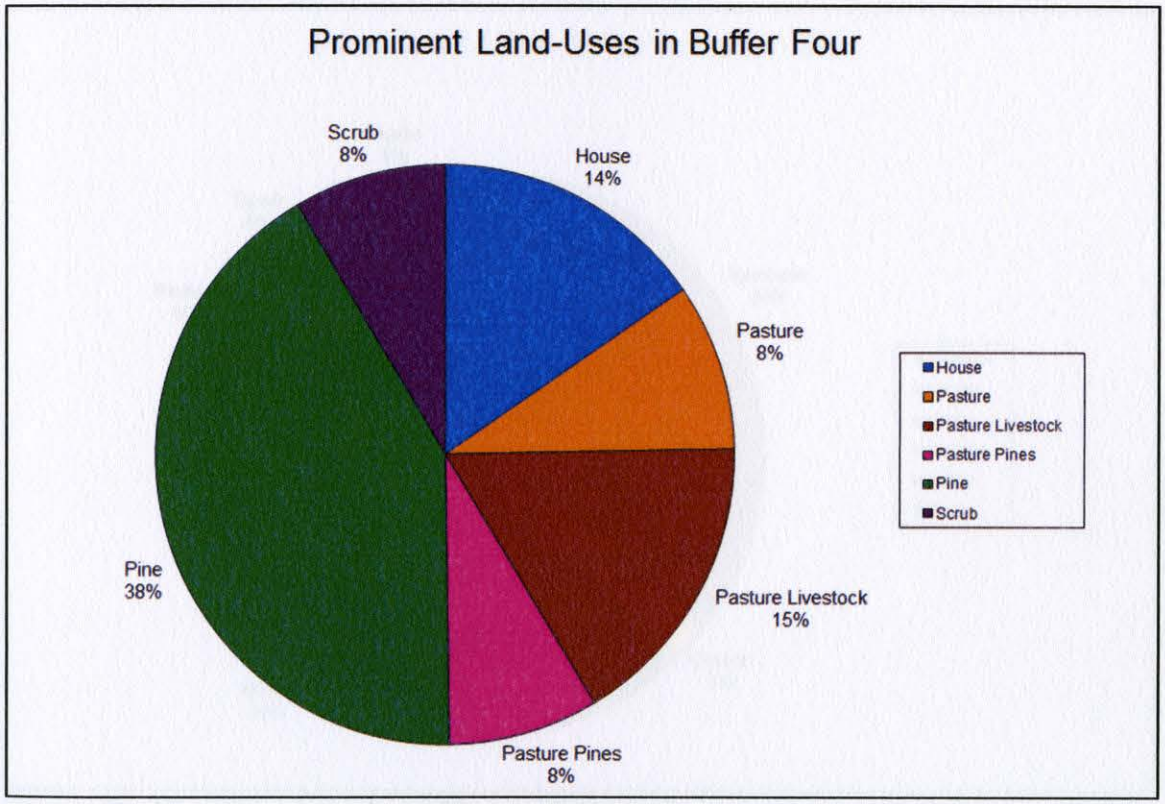

Figure 44 Most Prominent Land Uses in Improve/Baxterville.

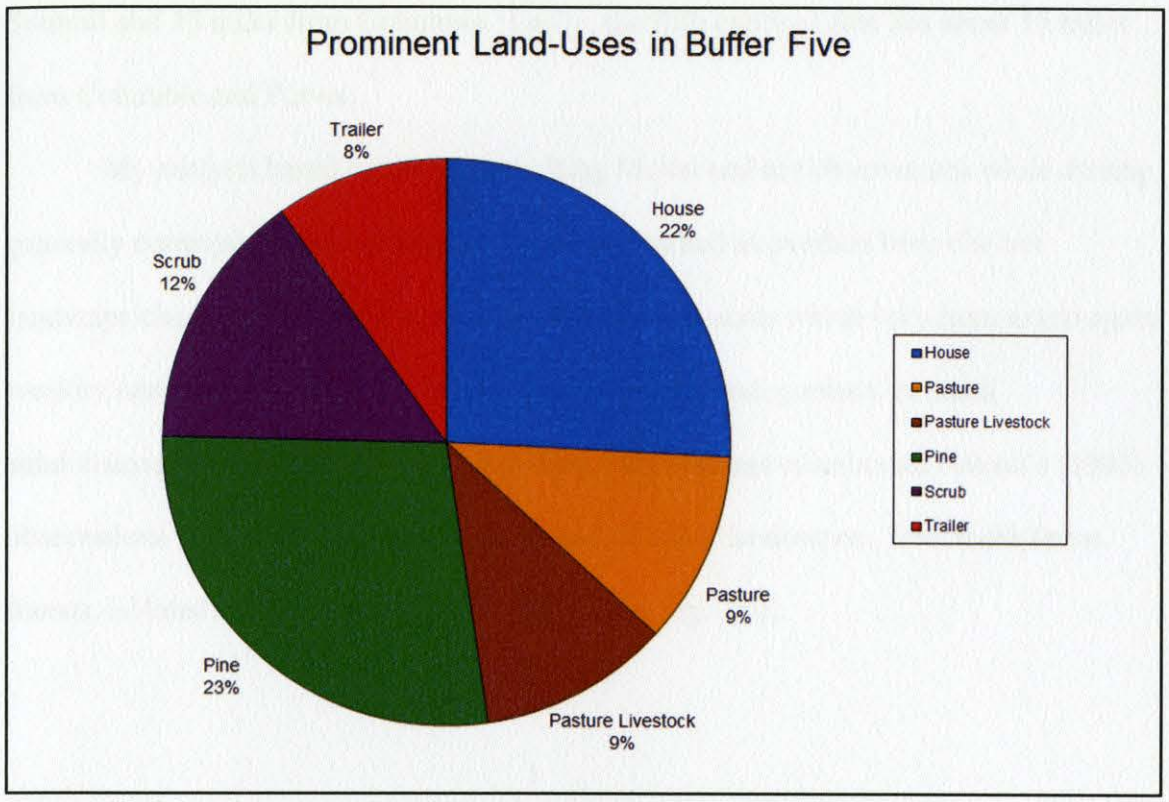

Figure 45 Most Prominent Land Uses in East Columbia/Lumberton.

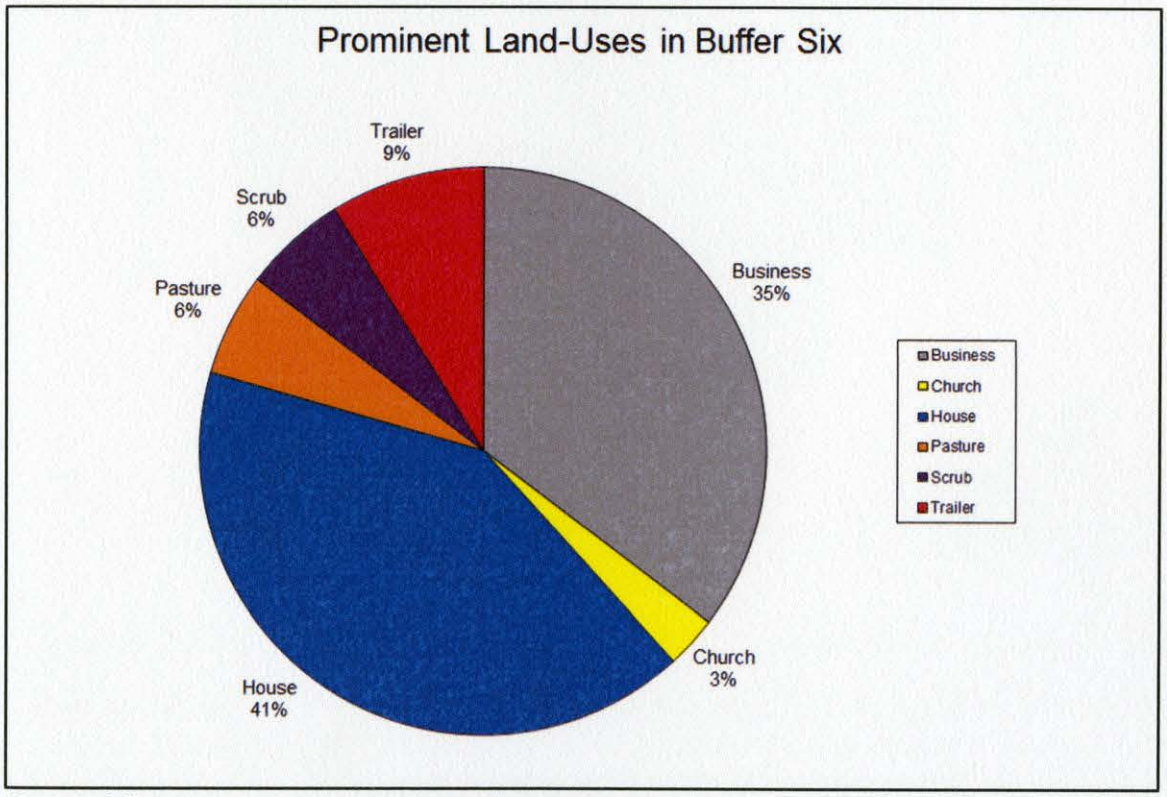

Figure 46. Most Prominent Land Uses in Columbia.

Sumrall and 15 miles from Columbia. Lastly, the fifth exurban area lies about 15 miles from Columbia and Purvis

My analysis based on the Burgess Ring Model and my observations while driving generally correspond with each other The areas marked as exurban have distinct landscape characteristics such as homes on two to five acres which vary from extravagant wealthy homes to low income trailers, possibly landscaped, gardens, or small subdivisions in the midst of pines and pasture. My findings corroborate Nelson's (1992) observations that, "Exurbia is really composed of many landscapes It includes farms, forests, isolated suburban subdivisions, and estates" (p. 350)

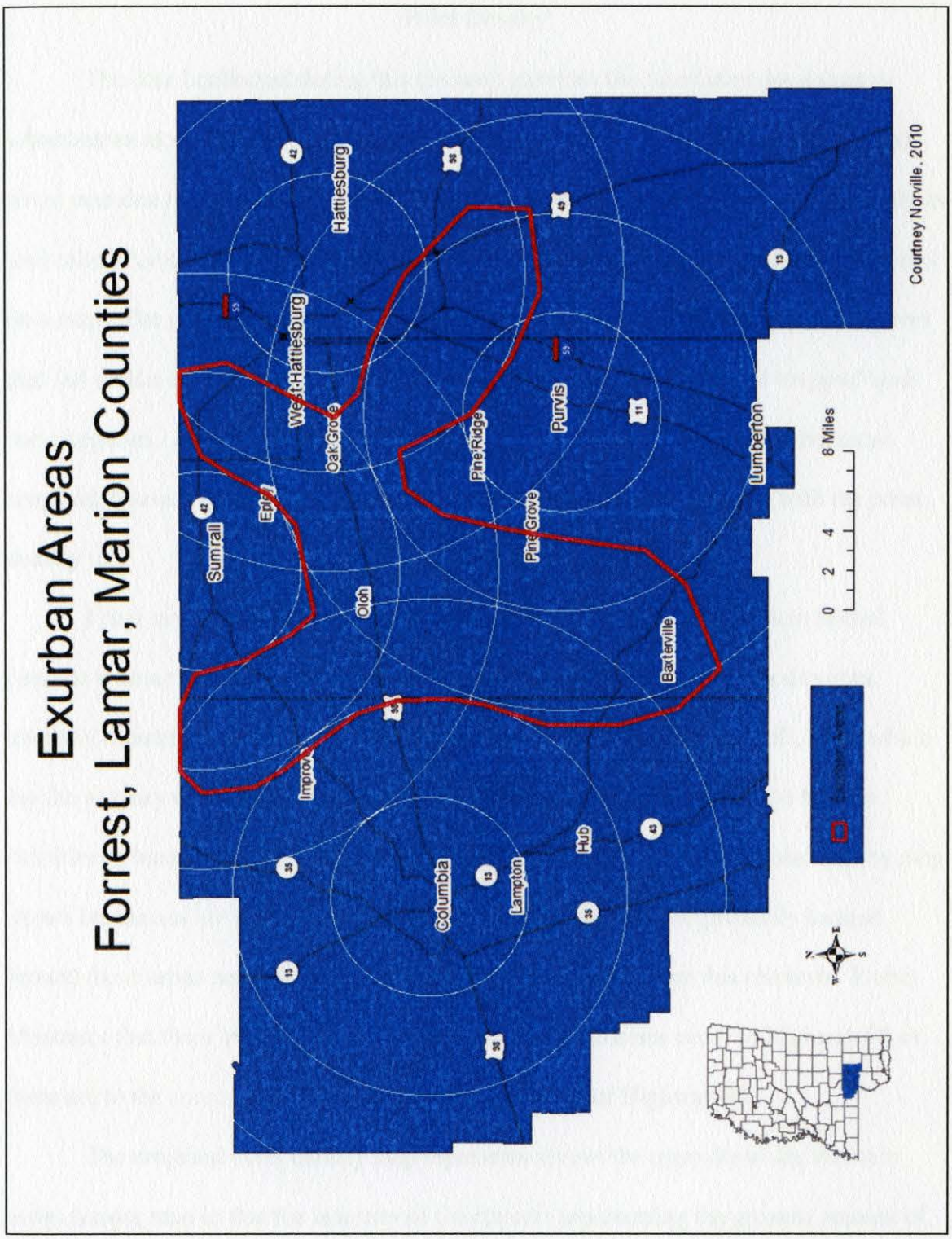

Figure 47 Exurban Areas Between Columbia, Hattiesburg, Purvis, and Sumrall, MS (Courtney Norville, 2010) I identified the exurban areas based on where the multiple ring buffers overlapped compared to where my hand mapped land use features changed in relation to urban, suburban, exurban, and rural areas.

Point Density

The data I collected during this research provides the foundation for a map of urbanization along the western periphery of Hattiesburg that resembles a land-use/land-cover map due to the various types of land use changes occurred. I used a spatial analysis tool called Point Density in ArcGIS 9.3 to visually portray clusters of land-use categories on a map. The point density tool calculates magnitudes per unit area from point features that fall within an area to create clusters of land-use points from the hand-mapped land-use categories. I chose to test the six most prominent land-use categories business, cropland, house, pasture-livestock, pine, and trailer land-use categories with the point density tool.

I first made maps of each land-use category individually to view their spatial patterns within the study area. The business point map shows the greatest densities around Columbia, Lumberton, Hattiesburg/Oak Grove, Purvis, and Sumrall, all of which are the primary cities within my study area (Figure 48) In other words, the highest densities of businesses correspond well with urban areas. The business point density map shows businesses are distributed throughout the study area but are primarily located around these urban centers, which confirms my initial ideas about this research. It also illustrates that there are roughly the same number of businesses north of Highway 98 as there are to the south, although there is more area south of Highway 98

The cropland point density map represents almost the opposite of the business point density map in that the majority of the clusters representing the greatest amount of cropland are further away from the cities in the exurban and rural areas (Figure 49)

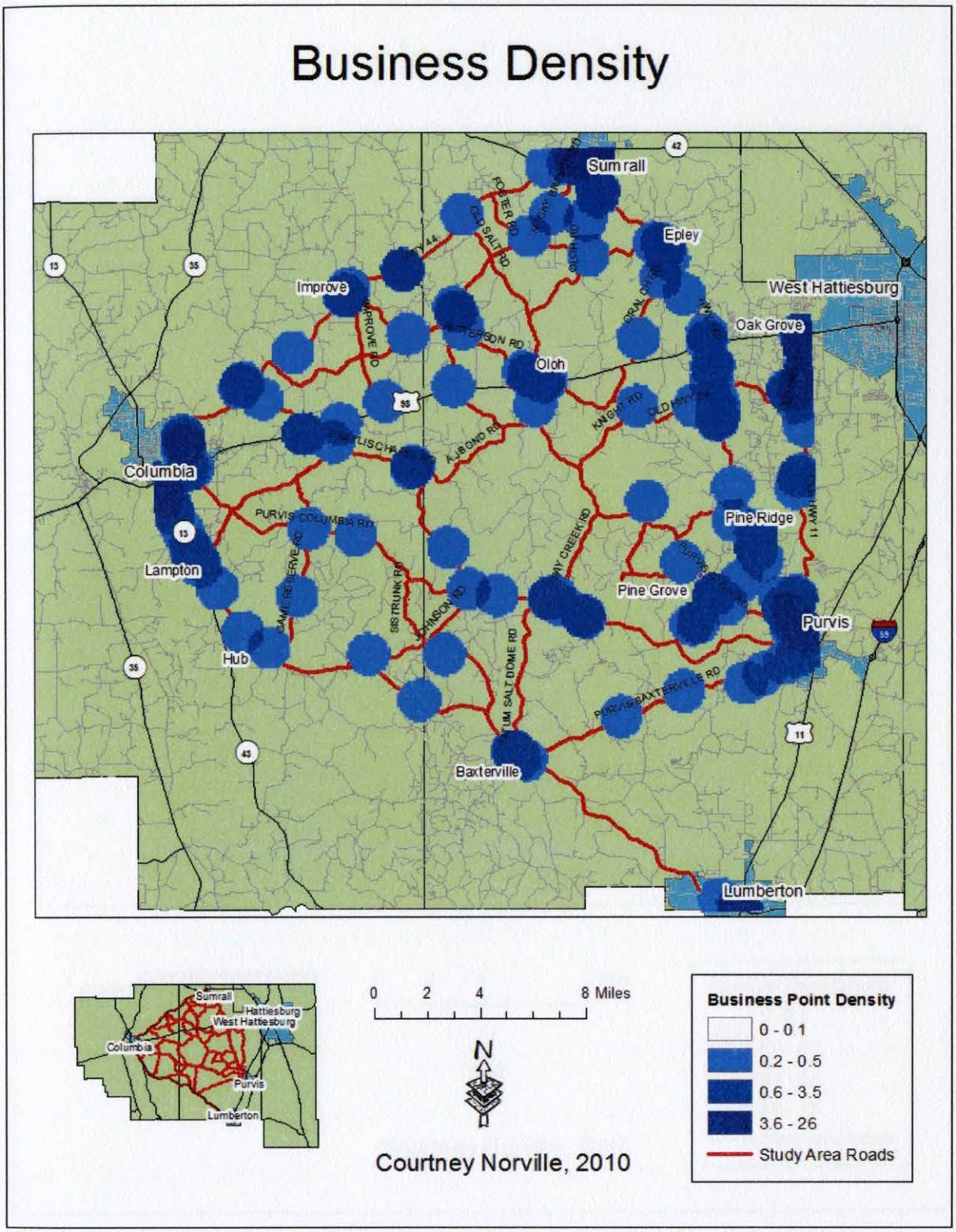

Figure 48. Business Point Density Map (Courtney Norville, 2010)

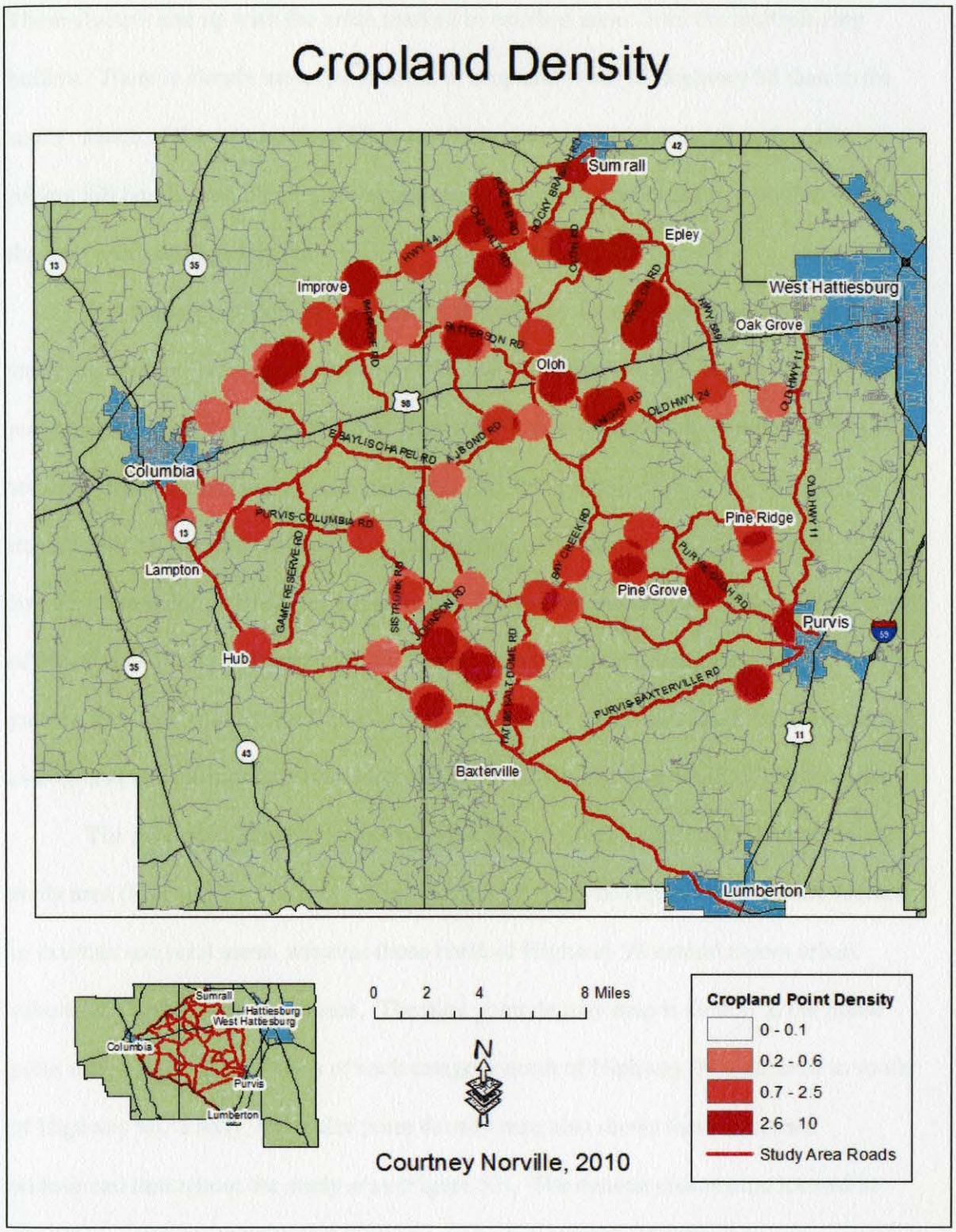

Figure 49 Cropland Point Density Map (Courtney Norville, 2010)

These clusters line up with the areas marked as exurban areas from the multiple ring buffers. There is clearly more dense areas of cropland north of Highway 98 than to the south. Much of the area north of Highway 98 is somewhat higher in elevation, has rolling hill landscapes, and has fewer intermittent streams and swampy woodlands than the area south of Highway 98.

The house point density map shows that houses are dispersed throughout the study area but are primarily located in urban and suburban settings (Figure 50). House point density is greater to the north of Highway 98 than to the south. Given that the area south of Highway 98 has more wetlands and low-lying terrain than to the north might explain why there are fewer houses in this portion of the study area. The pasture-livestock point density map has clusters with the greatest majority close to the city center of Purvis and Sumrall (Figure 51). This map also shows that the primary location of pasture-livestock is in exurban and rural portions of the study area that is more dense just as cropland and pasture-livestock land north of Highway 98 than south of Highway 98.

The pine point density map shows that pine is widely distributed throughout the study area (Figure 52) The most dense clusters lie south of Highway 98 and are located in exurban and rural areas, whereas those north of Highway 98 extend across urban, suburban, exurban, and rural areas. The pine point density map is similar to the house point density with denser areas of each category north of Highway 98 compared to south of Highway 98 Lastly, the trailer point density map also shows that trailers are widespread throughout the study area (Figure 53) The densest clusters are located in suburban, exurban, and rural areas with notably fewer trailers in urban areas except for

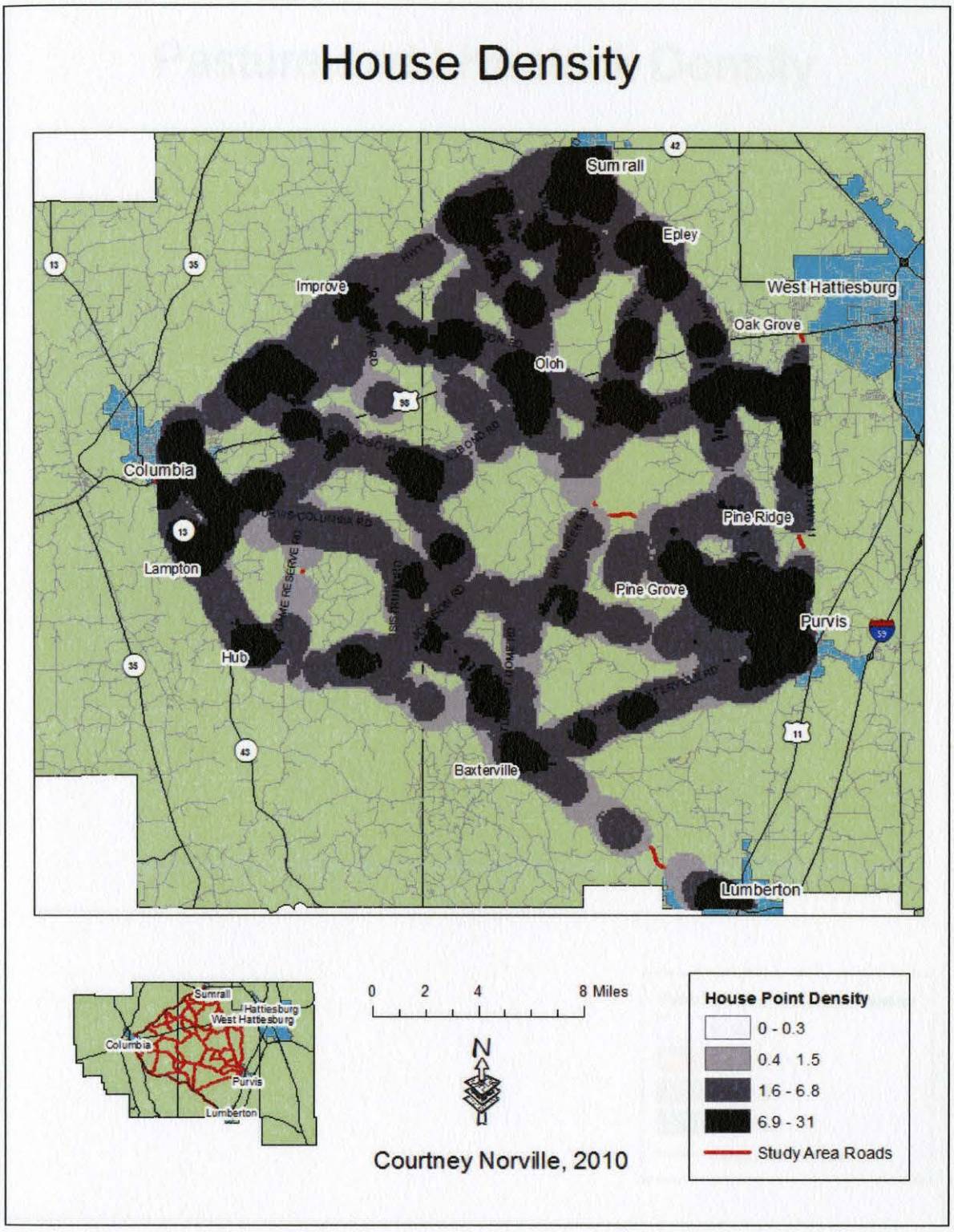

Figure 50. House Point Density Map (Courtney Norville, 2010).

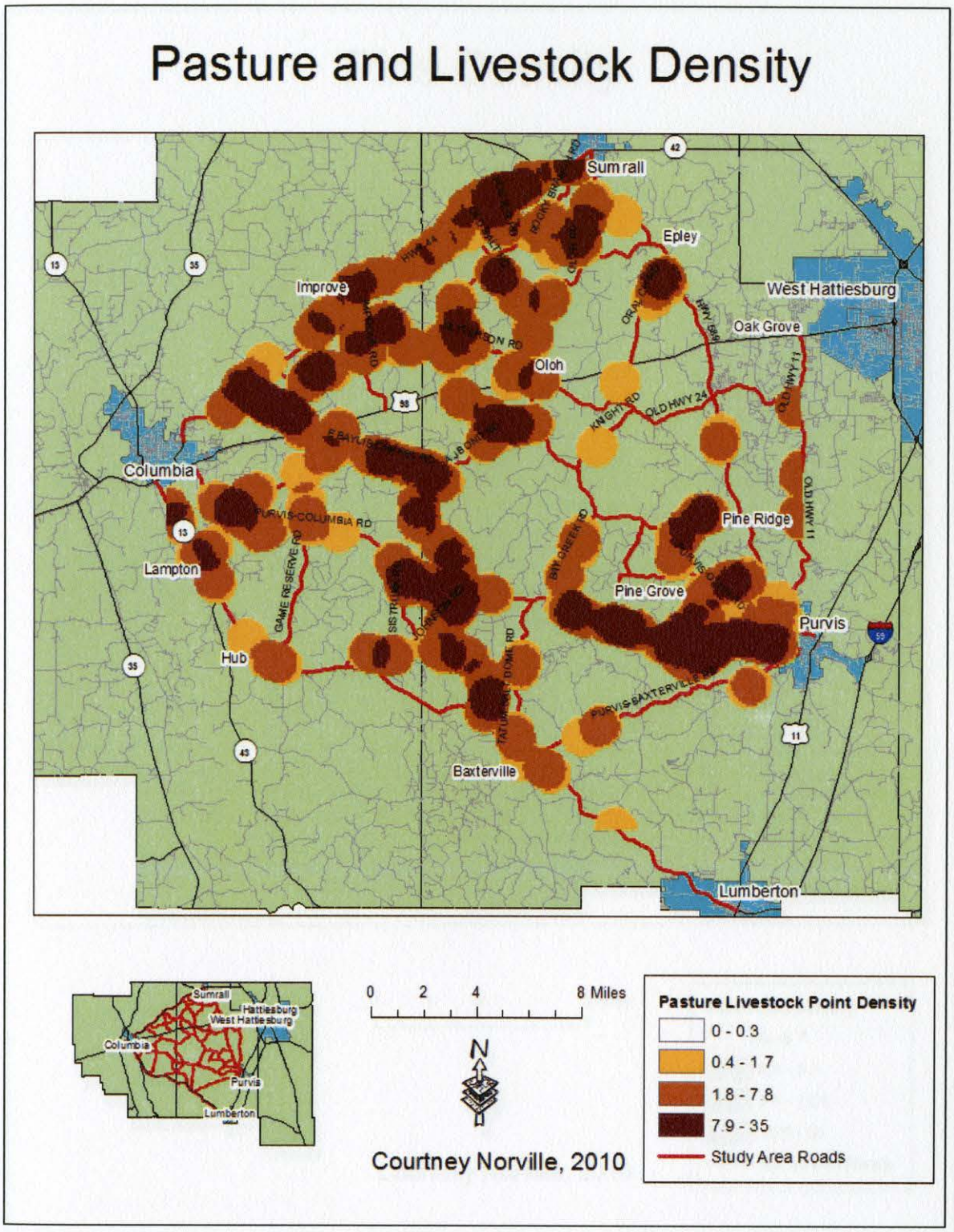

Figure 51 Pasture Livestock Point Density Map (Courtney Norville, 2010)

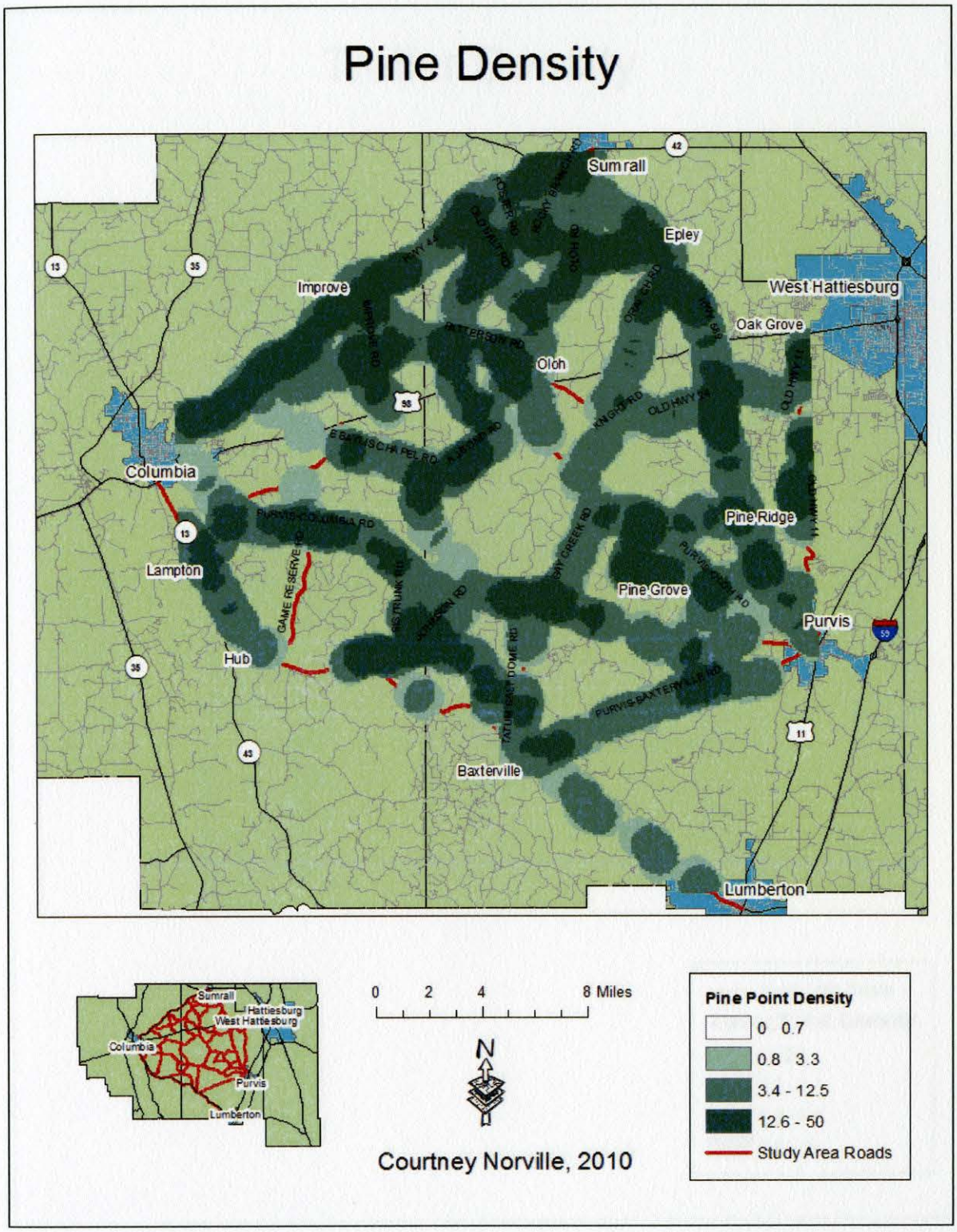

Figure 52. Pine Point Density Map (Courtney Norville, 2010).

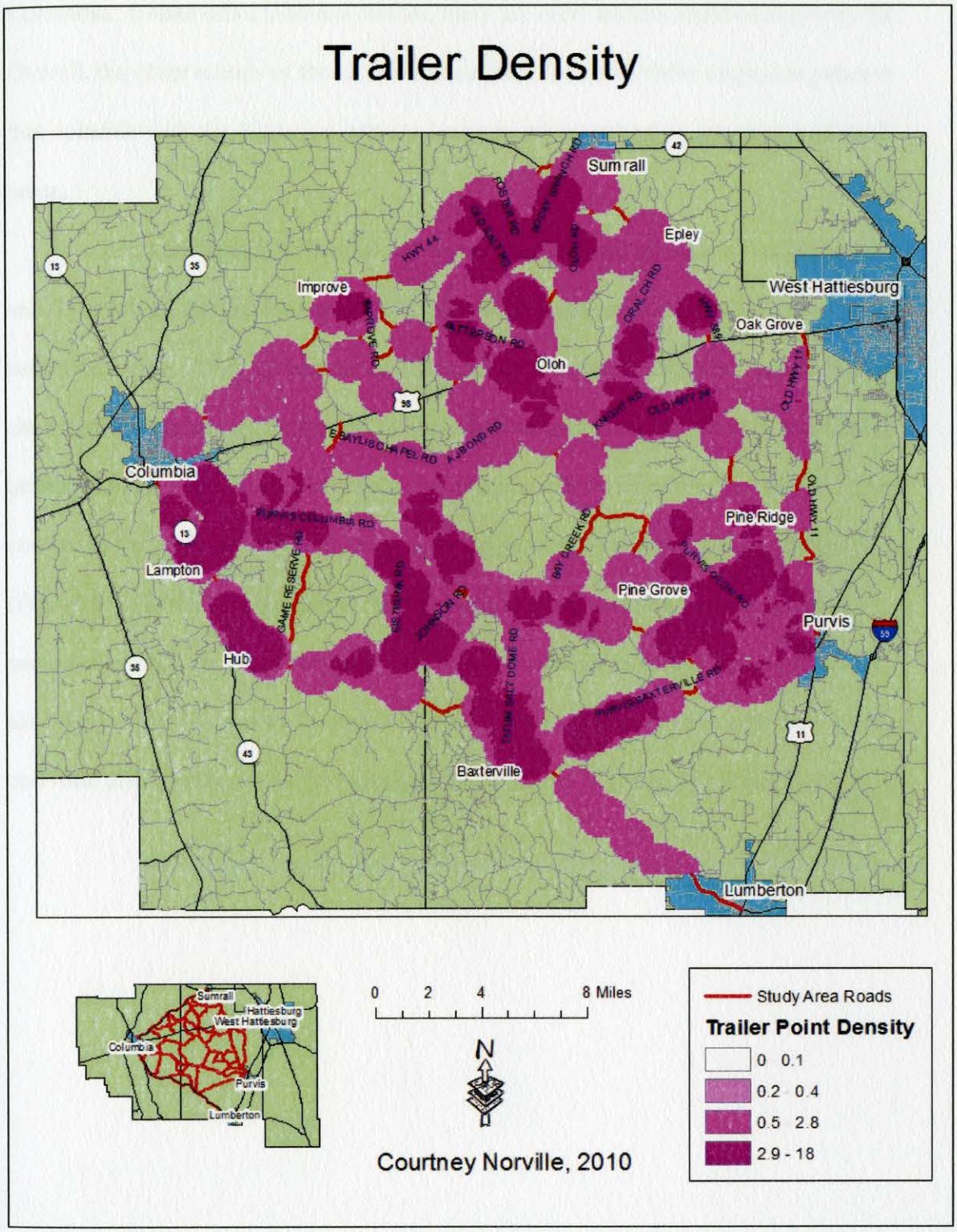

Figure 53. Trailer Point Density Map (Courtney Norville, 2010)

Columbia. Unlike other land-use classes, there are more trailers south of Highway 98. Overall, the observations of the six most prominent land uses show migration patterns that coincide with the migration patterns between urban, suburban, exurban, and rural areas.

Next, I combined the businesses versus cropland and businesses versus pasture and livestock to analyze their relative distributions across urban, suburban, exurban, and rural landscapes. I first compared the business and cropland categories, both of which show that businesses are in greatest magnitude near urban centers whereas cropland is primarily found in exurban and rural areas away from urban centers (Figure 54) I then compared the business land-use category to the pasture-livestock land-use category (Figure 55) Distribution of these two land-use categories shows there is far more pasture-livestock area than cropland. The map of businesses versus pasture-livestock also shows that the primary location of pasture-livestock is located in suburban, exurban, and rural areas where as the business land-use category is greatest in urban areas.

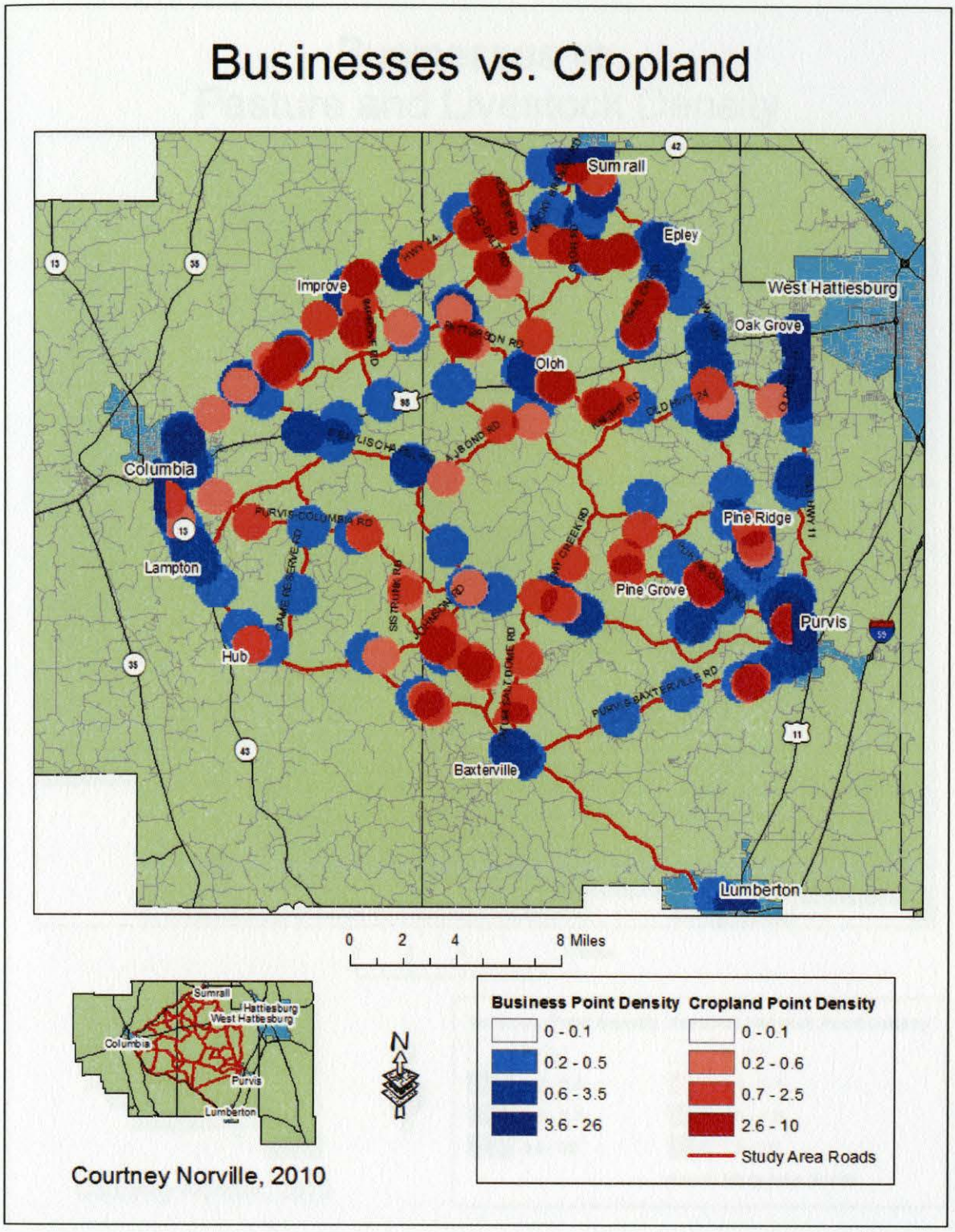

Figure 54. Business vs. Cropland Point Density (Courtney Norville, 2010)

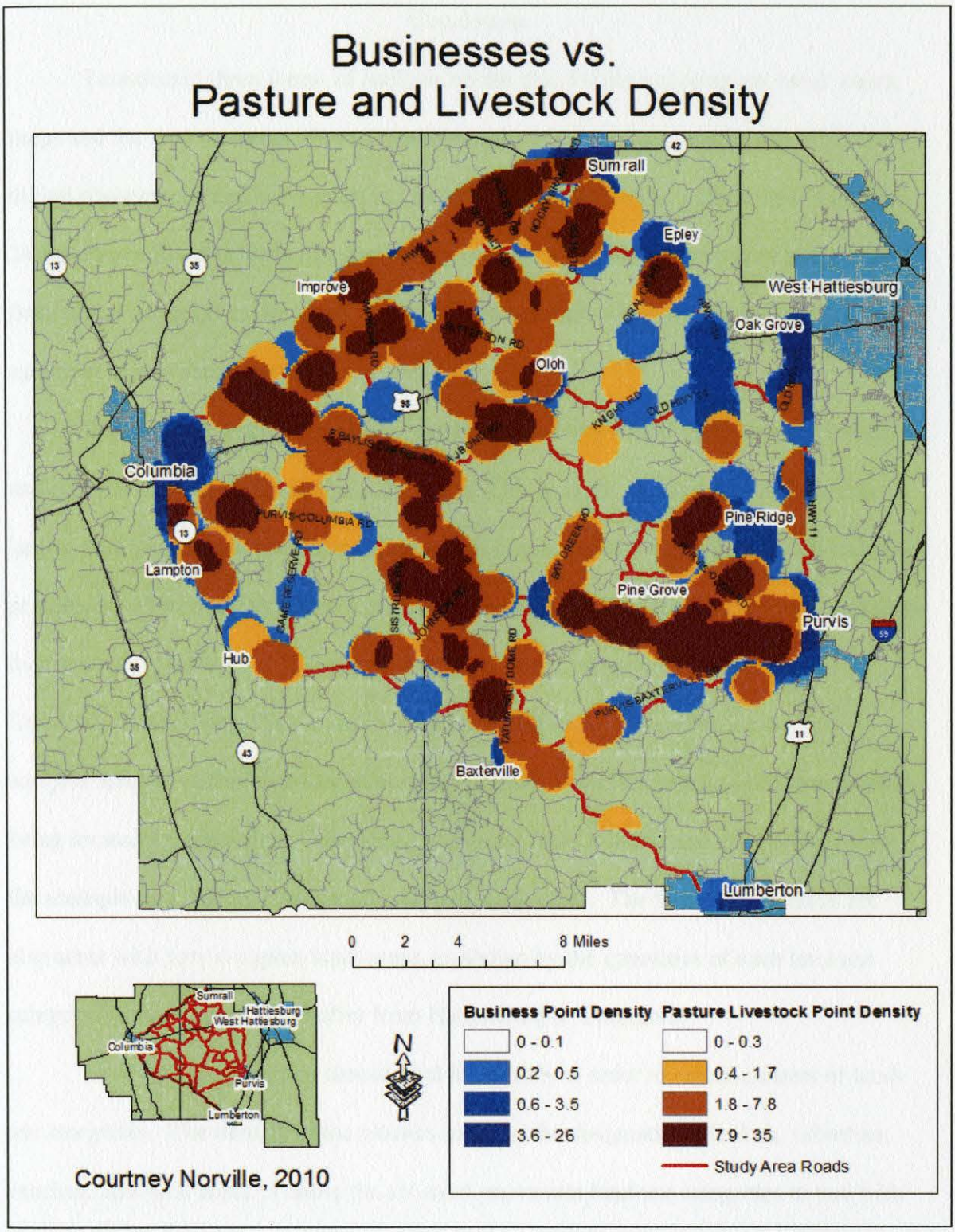

Figure 55 Business vs. Pasture Livestock Point Density (Courtney Norville, 2010)

Conclusion

I conducted three forms of analysis on the data I collected from my hand drawn maps and the road transects. First, I wrote narratives for a selection of roads using the digital photographs and hand-maps acquired from my fieldwork. I chose Old Highway 24 and Pierce Road to write narratives that portray some of my experiences to the reader. Both routes are good examples of how the landscape transitions from urban to suburban, suburban to exurban, or exurban to rural.

Second, I conducted a multiple ring buffer analysis of the study area to visualize and calculate areas of each land-use category. This analysis showed that pines are the largest land-use category in the study area with houses being second largest. Overall, the percentages of land-use categories in each buffer show a close relationship with regard to their proximity to cities. I also placed a multiple ring buffer around the cities of Columbia, Hattiesburg, Purvis, and Sumrall in order to locate exurban areas. The analysis resulted in five exurban areas lying 10 miles from Hattiesburg and Sumrall while being located 15 miles from Columbia and Purvis. This analysis and my findings with the multiple ring buffers correspond well with each other. The five exurban areas are also areas with very complex landscapes, as shown by the quantities of each land-use category in the multiple ring buffer from Hattiesburg to Columbia.

Lastly, I used the point density tool in ArcGIS in order to create clusters of land-use categories. The density of the clusters aided in the designation of urban, suburban, exurban, and rural areas. I chose the six most prominent land use categories to test with the point density tool that included businesses, cropland, houses, pasture-livestock, pines, and trailers. All six land uses have migration patterns that correspond to typical urban,

suburban, exurban, or rural land uses. For example, businesses are more prominent around urban areas compared to rural areas and cropland is most prominent in exurban and rural areas compared to urban areas. The results of the Burgess Model and Point Density analysis are consistent. The Burgess Model shows a greater percentage of houses near cities and decreasing as you move away from the cities into exurban and rural areas. The Point Density analysis also shows the greatest amounts of houses closer to cities and businesses than in the exurban and rural areas The Point Density maps and the exurban areas identified also prove to be consistent in that pockets of houses, cropland, businesses, and pasture located on the Point Density maps are located where the exurban areas in my analysis were located.

CHAPTER IV

CONCLUSION

My thesis juxtaposes very different approaches qualitative and quantitative – to study urban and exurban growth that are both unique and beneficial to the future of urban geography The geographical extent of my research consists of the roads and highways between the communities of Columbia, Hattiesburg, Purvis, and Sumrall, Mississippi, all of which are located in Forrest, Lamar, and Marion counties. My thesis focuses on how land-use changes associated with urbanization are perceived from an automobile using drive-by geography in order to answer the following questions.

- What aspects of land-use change can be seen from an automobile in Forrest, Lamar, and Marion counties of South Mississippi?
- Where is urbanization and exurban growth associated with Hattiesburg transforming the landscapes of Forrest, Lamar, and Marion counties?
- How can data collection from an automobile be used to inform GIS and remote sensing approaches to land-use change?

I first conducted transects along 45 routes between the cities of Columbia, Hattiesburg, Purvis, and Sumrall. While conducting these transects, I took field notes, digital photographs, GPS points, and sketched hand-drawn maps of each route to observe the impacts of urban and exurban sprawl on the landscape, better known as drive-by geography Conducting these transects made it possible for me to physically ground-truth and visually interpret the land-use characteristics along each route in my research area. Ground-truth of the different aspects of land-use change was imperative in order to show exactly what landscape change is occurring in areas, how urbanization and exurban

growth is transforming the landscapes of Forrest, Lamar, and Marion counties, and how data collection from an automobile can be useful with GIS and remote sensing approaches to urban geography

I developed a system of symbols to represent land-use categories that I used during field mapping (Figure 3, Page 17) that included 17 categories which are businesses, cemeteries, churches, cropland, houses, pasture, pasture with livestock, pasture with pines, pasture with both pines and livestock, pine plantations, retail complexes, schools, scrub vegetation, scrub vegetation with pine, trailers, trailer parks, and wildlife management areas (WMA) (Table 2, Page 18) In order to produce a map of urban sprawl in my study area, I converted the hand-drawn maps into ArcGIS shapefiles to overlay on county borders and road layers for digital interpretation and analysis. Lastly, I used ArcGIS to overlay the shapefiles onto Landsat imagery for subsequent interpretation and comparison with my transect field documents to show how much detailed can be gained from an automobile versus just the use of satellite imagery This method and the results are significant to qualitative research on cities and urbanization. In particular, data collection from an automobile can be used to ground truth GIS and remote sensing approaches, which rely on aerial photography and satellite imagery to detect land use and land cover changes (Castilla et al., 2009, Epstein et al., 2002, Srivastava & Gupta, 2003, Yang et al., 2003). GIS and remote sensing approaches use imagery in order to decipher and describe details of the landscape (Brown et al., 2005, Hepner & McKee, 1992, Pozzl & Small, 2005, Qlu et al., 2003, Wu et al., 2009) The acquisition of more details from an automobile, which I did for this thesis, illustrates the

potential for humanistic and qualitative research to inform quantitative, geospatial approaches to the study of urbanization.

I analyzed the data for my thesis using qualitative and quantitative methods. The three main methods of analysis include qualitative narratives and quantitative Burgess Ring buffer models and point density analyses. The narratives are a form of storytelling which I derived from digital photographs, hand-maps, direct observations, and memories to show how the landscape might be perceived from a vehicle. They provide insight into how I perceived human interactions with the landscape and relate to Lewis's quote describing the importance of landscape and place along with the need for us to understand their meanings rather than judging at first glance. I wrote narratives for Old Highway 24 South and Pierce Road. Pierce Road is not as long as Old Highway 24 South but both routes contain several visible landscape transitions of interest to this research.

In an effort to demonstrate the usefulness of my qualitative research, I used my results as the basis for a Burgess Ring Model and Point Density analysis. I used ArcGIS 9.3 to aid in the production of the Burgess Ring Model and the Point Density analysis. The Burgess model uses rings or zones moving away from an urban center to visualize urban growth and morphology (Hartshorn, 1980) The Burgess model is helpful in determining the location of transforming landscapes in Forrest, Lamar, and Marion counties by breaking the areas into sections that I was able to analyze.

My model consists of six rings around Hattiesburg, each being five-miles wide, moving outward until they reached Columbia (Figure 40, Page 62) I calculated the percentage of each land use found in each of the six rings (Table 3, Page 63) The

percentages of land-use categories in each buffer show a close relationship with regard to their proximity to cities and aid in characterizing urban growth west of Hattiesburg. The house and pasture-livestock land-use categories are good examples The percentage of houses near Hattiesburg and Columbia are greater compared to their percentage near Oloh or the second to fourth rings. By contrast, the pasture-livestock category has a lower percentage near Hattiesburg and Columbia with higher percentages in the second and third ring buffers, which are predominantly suburban and exurban areas.

Among the six ring buffers there were 16 land-use categories, of which six – business, house, pasture, pine, scrub, and trailer were the most prominent. The pine land-use category however has the highest percentage of area in all buffers, illustrating the dominance of pines in South Mississippi regardless of urban, suburban, exurban or rural settings. Pine trees are a native species to Mississippi so their dominance is to be expected. The fact that they are dominant in every buffer despite the setting is of interest. To me this shows that the people of this area try to keep their natural landscape until development is needed. Pines are not only native species but also good for timber, cash, agroforestry, wildlife, erosion control, and privacy The Burgess Model and the digital map of land uses showed that pines dominate the landscape of my study area no matter the distance between Hattiesburg and Columbia which this demonstrates a potential shortcoming of relying solely on remote sensed imagery Without my drive-by research, urban or suburban areas might be wrongly classified as rural landscapes because of the dominance of pines

The house land-use category proved most interesting. It is the fourth highest percentage in Buffer One, which is in Hattiesburg, and second highest in Buffer Six

which is in Columbia. Based on these percentages, the house category changed according to what would be expected with the transition among urban, suburban, exurban, and rural settings. I expected the business category would have been the highest in Buffer One instead of fourth. Yet business is actually fourth highest due to the prevalence of housing for the population of Hattiesburg and Oak Grove.

I also placed a multiple ring buffer around Columbia, Hattiesburg, Sumrall, and Purvis to ascertain the resulting pattern of overlapping buffers which would be exurban areas (Figure 47, Page 69) Areas marked as exurban have distinct landscape characteristics, such as homes on two to five acres which vary from extravagant wealthy homes to low income trailers, possibly landscaped, gardens, or small subdivisions in the midst of pines and pasture. Based on my analysis, there are five areas containing exurban landscapes that also correspond with the results of the Burgess rings

In order to identity areas as urban, suburban, exurban, and rural I used a Point Density spatial analysis tool on the land-use/land-cover map I created. This analysis was also used in order to compare urban and exurban growth between the routes north and south of Highway 98 The Point Density analysis was done using a spatial analysis tool in ArcGIS 9.3 to portray clusters of land-use categories on a map. I used the six most prominent land-use categories – business, cropland, house, pasture-livestock, pine, and trailer land-use categories to run this analysis on. After applying the point density tool, I created a land-use map for each of the six categories to view their spatial patterns individually The business point density map shows businesses are located throughout my study area but are primarily located around the urban centers (Figure 48, Page 71) In other words, the highest densities of businesses correspond well with urban areas, which

confirm my expectations with this research. It also illustrates that there are roughly the same number of businesses north of Highway 98 as there are to the south, although there is more area south of Highway 98 The point density map for cropland portrayed the opposite results of the business point density map. It showed that the greatest amount of cropland is located away from cities in the exurban and rural areas and north of Hwy 98 (Figure 49, Page 72) The house point density map shows houses dispersed primarily throughout urban and suburban areas whereas the trailer point density map shows trailers widespread in rural and exurban areas with notably fewer trailers in urban settings. House point density is greater to the north of Highway 98 with trailer point density being greater to the south of Highway 98

The pasture-livestock point density map shows a dispersal of the category but has clusters with the greatest density near the city centers of Purvis and Sumrall (Figure 51, Page 75) The pine and trailer point density maps show that both categories are widespread throughout the study area except that trailers are denser south of Highway 98 compared to pines Of these six land uses, cropland, houses, pasture-livestock, and pines are all more prominent north of Highway 98 Much of the area north of Highway 98 is somewhat higher in elevation, has rolling hill landscapes, and has fewer intermittent streams and swampy woodlands than the area south of Highway 98, which I believe plays a major role in the location of these land-use categories. Overall, as I expected, all six land uses had migration patterns that correspond to typical urban, suburban, exurban, or rural land uses.

I then combined some of the categories to further analyze the relative distribution among urban, suburban, exurban, and rural landscapes. I juxtaposed the business point

density to the cropland point density which showed businesses are in greatest magnitude at urban centers and cropland is primarily in the exurban and rural areas away from urban centers I also juxtaposed businesses to pasture-livestock which also showed that businesses are again at greatest magnitude at urban centers with pasture-livestock located in the suburban, exurban, and rural areas

My research and analysis activities all provided similar results. They showed that aspects of landscape change and land use can be seen from an automobile. My results showed that urbanization and exurban growth associated with Hattiesburg does move from the city center or urban area outward to suburban, exurban, and rural areas as expected. My research activities, which involved a drive-by research methodology and juxtaposing its data onto Landsat imagery show that data collection from an automobile can be very informative to GIS and remote sensing approaches to land-use change and urban geography By using these methods, I was able to look at everything in a landscape just as J.B Jackson argues we should. My method of drive-by geography also reinforced Pierce Lewis's idea of the importance of landscape and place in humanistic geographical research. The use of qualitative approaches such as the narratives aided in putting more meaning and detail into the research to show how human interactions with the landscape could explain the position and uses of such areas. In this sense, my research shows that humanistic geography has an important contribution to make to more quantitative approaches to land-use/landcover research.

My quantitative research helped validate my qualitative approaches by showing quantities and locations of the landscape categories. I used a more hands-on approach than typical GIS and remote sensing approaches to study landscape change but what I

believe to be effective. Typical remote sensing techniques primarily identify features by descriptors such as shape or spectral characteristics while relying on aerial photography, data packages, and satellite imagery GIS and remote sensing approaches also typically use temporal data and census data. Carrion and Irwin (2002) used landscape metrics which are applied in GIS software to analyze the pattern of residential land use change in Medina County from 1956-1996. Masek, Lindsay, and Goward (2000) did a case study using the Washington, D C. area to relate satellite-derived estimates of urban growth to economic and demographic drivers. They used Landsat data from 1973 to 1996 for a temporal look at urban growth. Their results show that urban growth surrounding Washington, D C. expanded outwardly each year These studies correlate to my study in that urban growth expands outwardly from the urban centers The major difference in most GIS and remote sensing studies and mine is the temporal data where my data is from one year instead of several.

The concept of drive-by geography has potential for application in studies that require very detailed field verification and ground truthing. Most important is the ability to gain firsthand knowledge and detail about an object and area versus information that might otherwise only be gathered from remote sensing techniques. In other words, land-use changes can be viewed along the road while performing drive-by geography, giving researchers the ability to collect more detail at a closer range than what is possible from satellite imagery Through this research, I have shown that the way in which landuse changes are perceived based on the methods of research and analysis done will determine the detail of the outcome and results

APPENDIX A

RECORD OF EACH TRANSECT

Road	Date	Start Time	End Time	Minutes	Start Mileage	End Mileage	Miles
Atwood Road	1/19/2010	11:33AM	11:35AM	2	165099	165099	1
Christian Union Road	6/30/2009	1.50PM	1.55AM	5	153405	153406	1
Foster Road	6/28/2009	8.11AM	8:20AM	9	153144	153146	2
Highway 42	1/19/2010	12:05PM	12:27PM	22	165118	165122	4
Highway 44	1/19/2010	12:28PM	1:44PM	76	165122	165142	20
Highway 589 North	6/30/2009	11:05AM	11:50AM	45	153375	153385	10
Highway 589 North	1/19/2010	11:50AM	12:05PM	15	165118	165118	1
Improve Road	6/30/2009	1 10PM	1:20PM	10	153400	153405	5
J.C. Riley Road	6/30/2009	1.55PM	2:20PM	25	153406	153410	4
N Mill Creek Road	6/28/2009	8:00AM	8.10AM	10	153141	153143	2
Old Highway 24 North	1/19/2010	11 14AM	11:33AM	19	165097	165099	2
Old Salt Road	6/28/2009	8.25AM	9:00AM	35	153148	153155	7
Oloh Road	6/28/2009	5:28PM	6:00PM	32	153199	153205	6
Oral Church Road	6/28/2009	4:45PM	5:07PM	22	153190	153194	4
Patterson Road	6/30/2009	2:33PM	2.50PM	17	153416	153419	3
Pierce Road	1/19/2010	2.36PM	2.54PM	18	165159	165162	3
Rocky Branch Road	6/30/2009	12:00PM	1:00PM	60	153385	153397	12
Rocky Branch Road	4/15/2010	11 18AM	11:56AM	38	171420	171427	7
Scruggs Road	6/28/2009	7:40AM	8:00AM	20	153138	153141	3
A J Bond Road	12/16/2009	12.10 M	12:25PM	15	163046	163049	3
Arena Road	6/26/2009	1.30PM	1:40PM	10	153031	153031	1
Baxterville-Purvis Road	6/29/2009	1 10PM	2:00PM	50	153274	153286	12
Bay Creek Road	6/29/2009	2.35PM	2.50PM	15	153298	153302	4
Brushy Creek Road	11/17/2009	3:00PM	3 10PM	10	161521	161524	3
Caney Church Road	1/13/2010	11·15AM	11:23AM	8	164213	164215	2
Doc Johnson Road	6/26/2009	5:00PM	5:20PM	20	153078	153081	3
E. Baylis Chapel Road	12/16/2009	12:25PM	12:50PM	25	163046	163054	8
Game Reserve Road	11/17/2009	2:43PM	3:00PM	17	161515	161521	6
Haden Road	6/26/2009	5:40PM	5.50PM	10	153090	153093	3
Highway 13	6/2/2009	2.15PM	4:00PM	105	150361	150388	27
Highway 13	6/22/2009	11:40AM	2.15PM	155	152700	152747	47
Highway 13	7/2/2009	2:00PM	2.10PM	10	153476	153477	1
Highway 13	7/2/2009	4:00PM	4:20PM	20	153546	153552	6
Highway 589 South	6/29/2009	11 15AM	12:30PM	75	153238	153251	13
J D Broome Road	12/16/2009	11:40AM	12:05PM	25	163039	163043	4

Johnson Road	1/13/2009	11:38AM	11:48AM	10	164219	164221	2
Knight Road	6/23/2009	1 10PM	1:30PM	20	152854	152858	4
Lampton Hilltop Road	11/17/2009	2:00PM	2:30PM	30	161501	161510	9
Lookout Tower Road	6/26/2009	1:40PM	1.50PM	10	153032	153034	2
Lookout Tower Road	6/26/2009	1:20PM	1:30PM	10	153029	153031	2
Luther Lee Road	1/27/2010	10:18AM	10:43AM	25	166384	166387	3
Luther Saucier Road	1/13/2010	11:48AM	11.52AM	4	164221	164222	1
Midway Church Road	6/26/2009	12:00PM	12:20PM	20	153012	153013	1
Old Highway 11	1/12/2010	11:22AM	12:54PM	32	164044	164056	12
Old Highway 24 South	6/2/2009	9:20AM	12:00PM	160	150300	150312	12
Old Highway 24 South	6/30/2009	2:30PM	2.33PM	3	153416	153416	1
Pine Burr Road	1/13/2010	10:38AM	11 15AM	37	164206	164213	7
Prosperous Ridge Road	1/13/2010	11.55AM	12:19PM	24	164222	164226	4
Purvis-Oloh Road	6/2/2009	12.15PM	2:00PM	45	150326	150344	18
Purvis-Columbia Road	1/12/2010	1:20PM	1:32PM	12	164070	164072	2
Purvis-Columbia Road	1/13/2010	1:23PM	2:55PM	92	164252	164278	26
Sistrunk Road	1/13/2010	10:10AM	10:30AM	20	164200	164203	3
Tatum Salt Dome Road	6/29/2009	3:00PM	3 10PM	10	153303	153310	7

Total Minutes 1614	Total Miles 356

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